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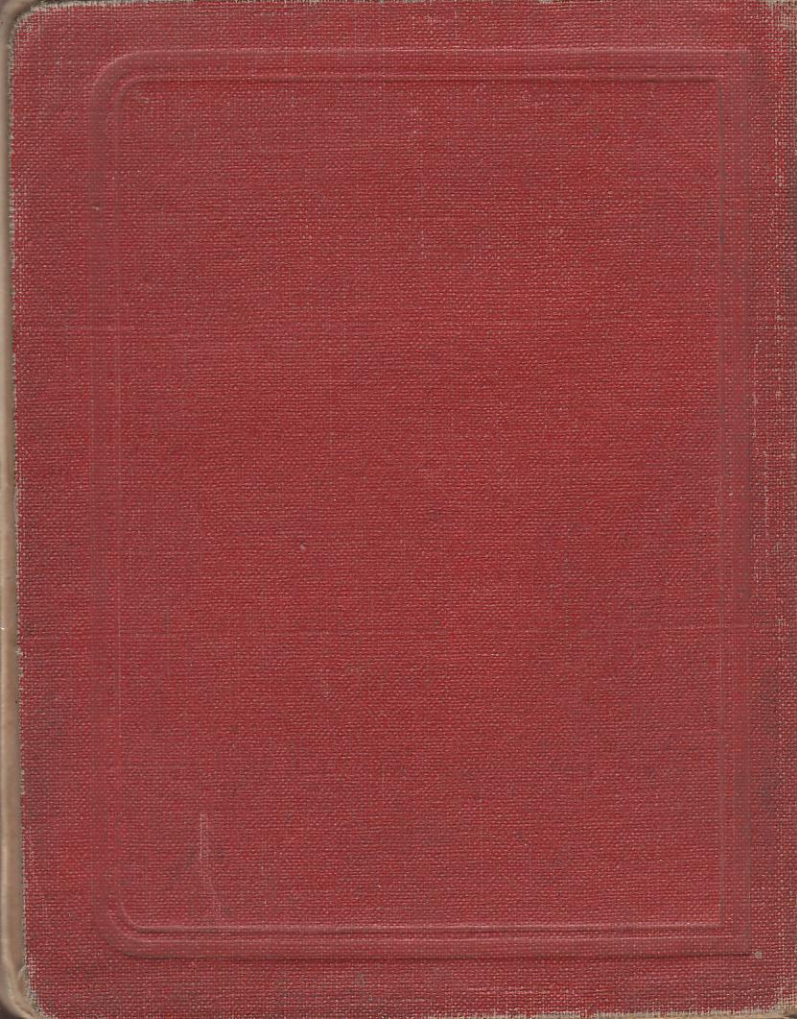
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# MACHINE GUN TRAINING

1925

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## MACHINE GUN TRAINING

### DEFINITIONS

*Arc of fire.*—The zone or area of ground within which it is desired to engage targets from a given gun position.

*Combined sights.*—The method of engaging any required depth of ground by applying overlapping beaten zones simultaneously from two or more guns.

*Drift.*—The term used to express the lateral deviation of the bullet after it has left the barrel due to the rotation of the bullet.

*Fire organization.*—The arrangements made by the higher commander to secure co-operation in the fire of various arms and units.

*Fire direction.*—The term applied to instructions given by an officer commanding more than one fire unit to his fire unit commanders as to how the fire of units is to be applied.

*Fire control.*—Means the fire orders given by fire unit commanders to their men.

*Limbers.*—Those G.S. limbered wagons detailed to carry the guns, tripods and first supply of ammunition.

*In action.*—A machine gun is said to be in action when it is mounted with reference to its arc of fire and loaded.

*Laying.*—The process of elevating (or depressing) and traversing a gun till its axis is made to point in any given direction. On conclusion of this process the gun is said to be laid.



*Observing post.*—A position whence the movement of our own troops and the target can be observed and from which the fire of machine guns is controlled and corrected.

*Position in readiness.*—A position in which guns and personnel are assembled preparatory to coming into action.

*Ranges, machine gun.*—Terms applied to:—

Close range—up to 800 yards.

Effective range—from 800 to 2,000 yards.

Long range—from 2,000 to 2,900 yards.

*Ranging.*—Ranging is the process of determining by observation of fire the direction and elevation required to hit a given target.

*Registering.*—The recording of the direction and elevation necessary to hit any given target as found by ranging.

*Rendezvous.*—A pre-arranged place of assembly.

*Searching.*—The method of engaging any required depth of ground by applying successively overlapping beaten zones from one or more guns.

*Traversing.*—The method of engaging any required width of ground by applying successive and overlapping beaten zones of fire laterally on it.

*The axis of the barrel* is an imaginary line following the centre of the bore from breech to muzzle.

*The line of departure* is the direction of the bullet on leaving the muzzle, i.e., the prolongation of the axis of the barrel at the instant of explosion.

*The line of fire* is a line joining the muzzle of the gun and the target.

*The line of sight* is a straight line passing through the sights and the point aimed at.

*The culminating point* is the greatest height above the line of sight to which the centre bullet of the cone rises in its flight. This is reached at a point a little beyond half the distance to which the bullet travels. (For the definition of a "cone," see below).

*The trajectory* is the curved path taken by a bullet during its flight.

*Cone of fire* (Fig. 1).—The figure formed in the air by the several trajectories of the bullets fired, and bounded by the trajectories of the outermost shots of a burst of fire.

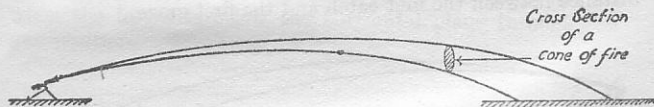


FIG. 1.

*First catch* (Fig. 2).—The point where the lowest bullet has descended sufficiently to strike the head of a man, whether mounted, standing, kneeling or lying.



FIG. 2.

*First graze* (Fig. 3).—The point where the lowest bullet, if not interfered with, will first strike the ground.



FIG. 3.

*Beaten zone*—The area of ground beaten by a cone of fire—

- i. The length is great compared with the width.
- ii. The approximate dimensions of the beaten zones of the Vickers gun are given in the range table, Appendix I. Only the best 90 per cent. of the shots are taken into account.

*Dangerous space* (Fig. 4).—For any particular range, is the distance between the first catch and the first graze.



FIG. 4.

*Dangerous zone* (Fig. 5).—In a burst of machine-gun fire the dangerous zone is an area equal to the beaten zone plus the area formed by the dangerous space for the lowest bullet.



FIG. 5.

*Defiladed zone* (Fig. 6).—The area of ground which would be included in the beaten zone, but for the fact that it is unswept by fire by reason of the gradient of the ground being greater than the gradient of the bullets.



FIG. 6.

*Angle of sight* (Figs. 7 and 8).—The angle contained between the line of sight and the horizontal plane.

By convention, the angle is said to be positive (+) when the target is above the horizontal plane, and negative (−) when the target is below the horizontal plane through the gun position.

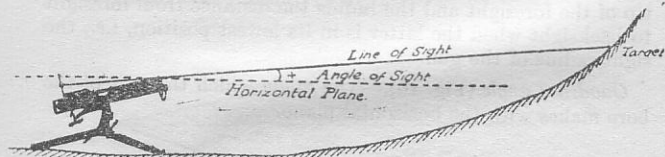


FIG. 7.

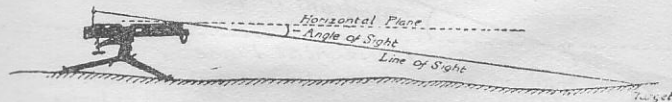


FIG. 8.

*Angle of tangent elevation* (Fig. 9).—The angle which the line of sight makes with the axis of the bore. For the sake of brevity this angle will be known as the tangent angle, and will be so referred to throughout this manual.

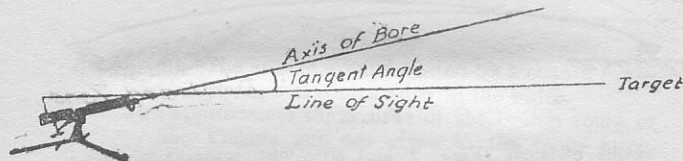


FIG. 9.

*Note.*—The angle of tangent elevation is so called because it is put on by means of the tangent sight. The tangent sight derives its name from the fact that the stem of the sight forms a tangent to the circle, of which the centre is the tip of the foresight and the radius the distance from foresight to backsight when the latter is in its lowest position, i.e., the sight radius of the gun.

*Quadrant angle* (Fig. 10).—The angle which the axis of the bore makes with the horizontal plane.

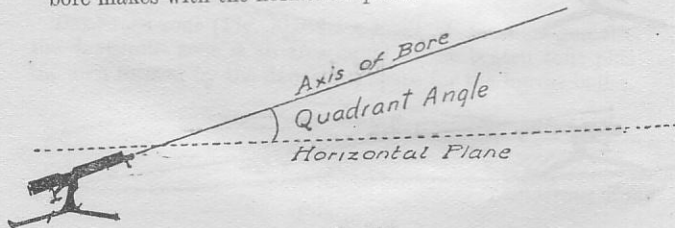


FIG. 10.

*Note.*—Relation between the quadrant angle (Q.A.), tangent angle (T.A.) and angle of sight :—

(a) Target above gun (Fig. 11).

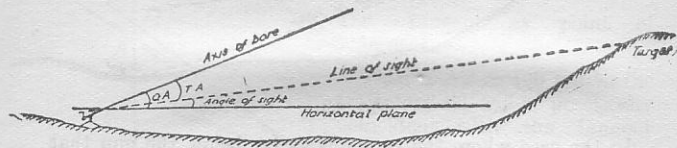


FIG. 11.

When the target is above the gun, the quadrant angle is equal to the tangent angle plus the angle of sight.

(b) Target below gun (i) (Fig. 12).

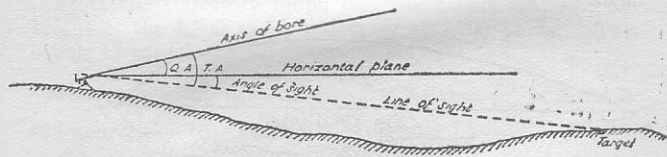


FIG. 12.

When the target is below the gun, the quadrant angle is equal to the tangent angle minus the angle of sight.

Target below gun (ii) (Fig. 13).

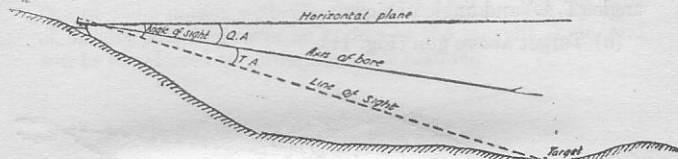


FIG. 13.

In the case where the target is so far below the gun that the angle of sight is greater than the tangent angle, the quadrant angle is negative.

From the above it will be seen that the relation can be expressed by the general formula:— $Q.A. = T.A. \pm S$ , where  $S$  = angle of sight.

*Angle of descent* (Fig. 14).—The angle which the tangent to the trajectory, at the point of impact, makes with the line of sight.

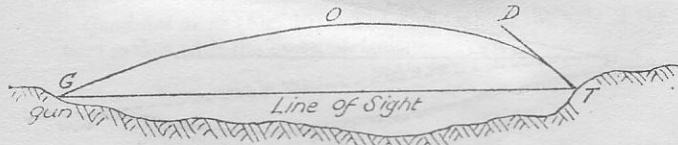


FIG. 14.

GT = line of sight. DT is the tangent to the  
 GOT = trajectory. trajectory at the point of  
 T = point of impact. impact.  
 Then angle DTG = Angle of descent.

For all practical purposes this can be calculated in the following manner (Fig. 15):—

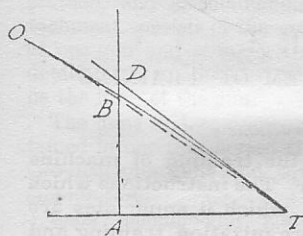


FIG. 15.

OBT is the trajectory.

AT = line of sight.

DT = tangent at point of impact.

Then if AT = 100 yards, the trajectory BT will be practically coincident with the tangent DT, and we can assume that the angle BTA = DTA.

The distance BA can be found for any range, from the trajectory graph. (Appendix II.)

Then angle BTA =  $\frac{BA}{AT} \times 3,400$  = Angle of descent.

*Example.*—Find the angle of descent for 1,800 yards.

From the trajectory graph find the height BA, i.e., the height of the 1,800 yards trajectory at 1,700 yards. This equals 12 yards.

Then angle of descent =  $\frac{BA}{AT} \times 3,400 = \frac{12}{100} \times 3,400 = 408$  min. (Compare Column 3, Appendix I.)

*Minimum clearance.*—The minimum clearance is the height at which the centre of the cone of fire must pass above the heads of troops fired over.

*Safety angle.*—The safety angle is the minimum angle which must be included between the line of sight to our own troops and the axis of the barrel in order to ensure their safety under overhead fire.



## PART I.—TRAINING

### CHAPTER I

#### PRINCIPLES AND SYSTEM OF TRAINING

##### 1. *General instructions*

1. This manual deals with the training of machine gunners and their duties in war. The instructions which it contains and the principles which it enunciates are based on the doctrine for the organization, training and leadership of the Army, as set forth in Field Service Regulations, a knowledge of which is incumbent on every officer.

2. The enunciation, by officers responsible for the training of machine gunners of principles other than those contained in this manual, and the practice of methods not based on those principles are forbidden.

3. Throughout this manual the principles laid down for the training of a machine-gun platoon apply equally to a machine-gun squadron, where it is not otherwise specifically stated.

##### 2. *Organization*

1. The machine-gun platoon, commanded by a major or captain, forms an integral part of an infantry battalion and composes No. 2 group of the headquarter wing. It consists of a headquarters and two sections numbered I and II. Each section, commanded by a subaltern, consists of headquarters and two sub-sections, which are lettered A, B, C and D

throughout the platoon. Each sub-section consists of two gun detachments, which are numbered 1 to 8\* throughout the platoon, and is commanded by a serjeant. Each gun detachment consists of the gun numbers detailed for the service of one gun and is under the immediate control of the gun-detachment commander, who will be a corporal and will not be the firer of the gun.

The guns and equipment of each sub-section are self-contained in one four-horsed G.S. limbered wagon, which carries two machine guns and equipment and the first supply of ammunition.

Each machine-gun platoon has two two-horsed G.S. limbered wagons carrying reserve S.A.A.

The section is a tactical as well as a fire unit; the sub-section is a fire unit only and not a tactical unit.

2. The machine guns of a cavalry regiment, which form No. 2 group of the headquarter wing, are organized in war as a machine-gun squadron divided into four troops, and in peace as a half-squadron composed of two troops, each of two guns.

The machine-gun troop is the tactical and fire unit, capable of detachment, and is divided into two gun teams.

When engaged in tactical exercises during peace training the half-squadron should be organized into four troops, each troop being represented by one gun, a flag representing the second gun.

3. A gun team consists of the gun numbers and pack leaders detailed for the service of one gun under the immediate control of a N.C.O.

\* *Note.*—This does not alter the principle of numbering guns in action from the right.

The guns and a first supply of ammunition are carried on pack horses and the gun teams are mounted. The reserve ammunition is carried in G.S. limbered wagons.

*Note.*—Throughout this manual the term “machine-gun squadron” includes the half-squadron in cases where the instructions refer to peace organization or conditions.

Where reference is made to “platoon,” “section,” “sub-section” or gun detachment, the equivalent formation is intended in the case of a cavalry unit.

4. Further details with regard to the above units will be found in War Establishments.

### 3. Responsibility for training

(See also Training and Manœuvre Regulations)

1. All commanders are responsible for the training and efficiency of their officers, N.C.Os., men and animals.

They are also responsible for ensuring that the guns, equipment, vehicles and animals under their charge are complete and fit for service.

2. The platoon (machine-gun squadron in the case of cavalry) is the principal training unit in machine-gun organization, and it is essential that it should be regarded as a self-contained unit.

3. Machine-gun units must be trained not only to act independently with the regiment or battalion to which they belong, but also to work collectively in co-operation with all arms.

Regimental and battalion commanders are responsible for the training and efficiency of their machine-gun squadrons or

platoons as regards individual and collective training, and that there is a capable subordinate to take the place of all commanders whenever the necessity arises.

Brigade commanders are responsible for seeing that machine-gun units in their brigade are trained collectively. They will issue such instructions as will enable all machine-gun units in the brigade to be concentrated for purposes of carrying out the higher forms of tactical and technical training which are essential if machine-gun units are to act collectively in co-operation with all arms.

Brigade commanders are, moreover, responsible for ensuring that individual and collective training is carried out on a uniform system within the brigade.

4. In each brigade an officer will be selected as “Brigade machine-gun officer.”

He will be responsible for ensuring that the orders of the brigade commander as regards machine-gun training are being carried out in all units of the brigade (*see* Sec. 78, 8).

### 4. General system of training

1. Men selected for posting to a machine-gun squadron or platoon must be trained cavalry or infantry soldiers.

They should have strong physique, good eyesight, calm temperament and a fair measure of education. Mechanical aptitude is also of value. The work of a machine gunner entails the frequent carrying of heavy weights, sometimes over long distances. Staying power and endurance are, therefore, of the utmost importance.

2. The close and constant support of their battalion or regiment in all phases of the battle is the *raison d'être* of

machine guns. Throughout his training this principle must be thoroughly inculcated in the machine gunner.

3. The annual training of the machine gunner must be progressive and continuous. With this object the year will be divided into two periods, devoted respectively to—

i. Individual training.

ii. Collective training.

The object of individual training is to prepare the individual officer, N.C.O. or soldier for the duties which he will be required to know to enable him to take part in collective training. Particular attention will be paid during this period to the training of junior officers and N.C.Os. with a view to their becoming efficient instructors.

The object of collective training is to render squadrons and platoons capable of manœuvre and co-operation in battle.

4. Collective training should begin with the training of the sub-section or troop, and continue with that of the section, platoon or squadron. Subsequently the machine-gun platoons of an infantry brigade (or the machine-gun squadrons of a cavalry brigade) should be brigaded to undergo a period of training under the brigade commander's orders.

Collective training should not be commenced until proficiency has been attained in the subjects of individual training.

5. To ensure that all units have serving with the colours the requisite number of trained machine gunners to meet their mobilization requirements and sufficient machine gunners in the reserve to replace wastage, commanding officers will, at the end of each collective training season, arrange for a turnover of 25 per cent. of N.C.Os. and 50 per cent. of troopers or privates, provided that these N.C.Os. have had four years'

training, and that the troopers and privates two years' training in the machine-gun squadrons or platoons.

#### 5. Individual training

1. Machine-gun officers and serjeants must receive a thorough training in all the subjects laid down in this manual and in the handbook for the .303-inch Vickers machine gun.

2. The training of all ranks in gas defence must be continuous throughout their service. Every officer, N.C.O. and man must be able to perform all his duties, both by day and night, while wearing the anti-gas respirator.

3. The individual training of other ranks in machine-gun subjects will consist of:—

i. The training of N.C.Os. and privates likely to become N.C.Os. in:—

The duties of a gun-detachment commander.

Elementary fire direction.

Fire control.

Reconnaissance.

Map reading.

Use of the prismatic compass.

The tactical employment of the gun.

The writing of messages and reports.

The subjects laid down in ii below.

ii. The training of troopers or privates in:—

All the subjects laid down in Part I of this manual.

Mechanism, &c. (Handbook for the .303-inch Vickers Machine Gun).

The use of the revolver.

iii. The training of drivers in:—

Riding, driving and stable management.

Use of ground.

Tactical use of limbers in the field.

iv. Range-takers will be trained in the unit. Officer and N.C.O. instructors will be trained at the Machine Gun School.

v. Scouts (*see* Sec. 42).

4. Training in the use of the revolver will be carried out in accordance with the instructions contained in Small Arms Training, Vol. II.

Officer and N.C.O. instructors will be trained at the Small Arms School.

A certain proportion of the personnel in every gun detachment is armed with the revolver, and as all the numbers of a gun detachment must be interchangeable, it is essential that every machine gunner should be trained in the use of the revolver.

*Note.*—Owing to the limited allotment of ammunition available, Nos. 1 and 2 only can be trained with ball ammunition. The remaining men of each gun detachment must receive instruction off the range.

5. The efficiency of machine guns so largely depends on the skill of the drivers and on the training and condition of the mules and horses, that the maintenance of a high standard of equitation, driving and horsemastership is essential in all machine-gun units.

**The limbered wagon is to the machine gun as the limber to the field gun.**

Complete tactical value cannot be obtained from machine guns without the ability to manœuvre limbers boldly and skilfully under fire. This demands highly trained officers,

drivers and teams. Such handling of limbers will effect a great saving of physical strain on the part of gun detachments.

Instruction in horsemanship, equitation and driving will be carried out in accordance with the instructions contained in Artillery Training, Vol. I, which are suited to the needs of machine-gun units.\* It must be remembered that machine-gun limbers are required to work closer to the enemy than field guns; faults in driving may lead to more fatal results with machine guns than with artillery. The standard required of drivers in machine-gun units is, therefore, at least as high, if not higher, than that necessary for artillery drivers.

6. The weapon training of a machine gunner will be carried out as laid down in Small Arms Training.

#### COLLECTIVE TRAINING

##### 6. *Sub-section and section training*

1. The platoon commander will allot such time as he considers desirable at the beginning of the annual course of training in field operations for the training of his sub-sections and sections. He will personally supervise this training, and thus ensure that each section is fit to take its place in the platoon.

2. All N.C.Os. and men of the section must be present for this training.

3. Platoon commanders will prepare, in accordance with instructions issued by the battalion commander, a programme of work to be carried out during the period allotted for section and platoon training.

\* The training of machine-gun squadrons of cavalry regiments in these subjects will be carried out in accordance with the instructions contained in Cavalry Training.



4. Success in battle will largely depend upon the efficiency of fire unit commanders. The practical training of all section and sub-section commanders is, therefore, of supreme importance.

In all circumstances, platoon commanders are responsible for seeing that not only all section commanders, but also all sergeants and corporals, are given such practice in command as will make them efficient fire-unit commanders.

5. It will be an advantage if during the period allotted to section training, one day a week is given up to carrying out a platoon exercise suited to the stage of training reached by the sections.

#### 7. Platoon training

1. The machine-gun platoon will be struck off all duties during the first months of the collective training period for a special course of training in field operations (see Chapter VIII), and for the Annual Machine-gun Course, and annual course of weapon training.

2. The chief points to which the platoon commander should devote his attention are :—

- i. Fire discipline and fire control.
- ii. Supply and replenishment of ammunition.
- iii. Internal communication within the platoon, and co-operation between the various members of platoon headquarters.
- iv. Fire tactics (the selection, occupation and preparation of gun positions and co-operation with other arms).
- v. Field engineering.
- vi. The training of section commanders in the solution of tactical problems.

3. At first it will often be advisable to take out only the officers, senior N.C.Os. and parties required for observation and communication. When these individuals have got to know their work and to understand each other, the whole platoon can be taken out.

Parties may, with advantage, be sent out to the positions against which the guns are to come into action to note where and when any of the personnel or material of the platoon are exposed to view, and to form targets for the guns. By such means the men will be enabled to see the mistakes made and learn to avoid them.

4. The difficulties which attend the supply of ammunition in the field make it important that practice, with the full complement of machine-gun transport, should be carried out as often as possible. In order to do this, arrangements should be made by the battalion commander to place the necessary animals and vehicles at the disposal of the platoon commander.

5. All training, other than formal parades, carried out beyond the precincts of barracks, whether other arms are present or not, should be based on some simple tactical scheme, which should be explained to all ranks beforehand.

6. The later stages of this period of platoon training must be made to synchronize with the battalion training of the battalion of which the machine-gun platoon forms part.

#### 8. Brigade training

1. As soon as the platoons have completed platoon training they will be inspected by the brigade commander, after which

the training of the brigade machine guns as a whole should be carried out for such time as the brigade commander may direct.

2. The object of this training is to enable the machine guns of the brigade to take part in any operation involving the employment of other arms.

To achieve this object, training in the following is necessary :—

- i. The selection and change of positions and of objectives, in accordance with the tactical plan.
- ii. The distribution of fire, in accordance with the progress of the fight, and the procedure to be adopted for this purpose.
- iii. Co-operation with the other arms, and inter-communication between the brigade machine-gun officer, the platoons and ammunition supply, and also between the brigade machine-gun officer and brigade headquarters and battalion commanders.

3. If arrangements cannot be made to carry out tactical training with the other arms, the action and effect of those arms must be considered in the solution of tactical problems.

4. Whenever possible a field-firing area should be allotted for the use of the brigade machine guns at the end of this period of training.

The object is two-fold, viz. :—

- i. To instruct all ranks in the application in the field of the approved principles of machine gunnery and machine-gun tactics with service ammunition.
- ii. To accustom commanders to acquire the habit of appreciating a situation quickly and correctly.

of arriving at an immediate decision, of translating that decision into suitable orders, and of ensuring their intelligent and rapid execution.

The schemes on which the tactical practice is based should deal with problems such as are likely to confront a commander in war. These schemes will be drawn up by the brigade commander, who should be present at the tactical practice and act as director of the operations. (*See Sec. 37, 12, Training and Manœuvre Regulations, 1923.*)

5. During winter training schemes should also be framed for the purpose of training machine-gun officers in the tactical principles laid down in F.S.R., Vol. II; Infantry Training, Vol. II and this manual. These exercises should be prepared in detail with maps, instructions and points for criticism. They should involve the rapid appreciation of a situation, the selection of the most appropriate method of fire direction, the issue of orders, the sending of situation reports and the rapid preparation of sketch maps. The actual presence of machine guns on such tactical schemes is of value in order to test, to some extent, the feasibility of the execution of the orders given. Their presence, however, is not essential for the conduct of the exercise.

## CHAPTER II

### INDIVIDUAL TRAINING

#### 9. Visual training; indication and recognition of targets

1. *Visual training.*—Frequent practice in the examination of ground should be given during the later stages of individual training. This should at first be confined to the recognition of natural and artificial features and the general character of the country; next, the importance of these features should be pointed out with reference broadly to the attack and the defence of the area in which they lie; and, finally, attention should be called to those which are of particular interest to the machine gunner, *e.g.*, positions for observation to the front and to the flanks, positions that offer a good field of fire, areas on which observation of fire is likely to be obtained, localities from which enemy attacks may develop, the visibility of sky-lines, &c. By such practice a necessary introduction will be obtained to the more detailed study of cover, reconnaissance, and the selection of gun positions (Sec. 42).

2. *Indication and recognition of targets.*—It is essential that the target should be described in such a way that the firer will recognize without delay the exact point of aim indicated to him. Owing to the close grouping of machine-gun fire, even small inaccuracies may result in total loss of fire effect, and, since machine-gun fire is often delivered under conditions

where the safety of the infantry or other troops has to be considered, a wrong point of aim may result in danger to our own troops.

3. Aiming points will be described wherever possible by the "direct method" *i.e.* without "aids." If necessary, they may be described with reference to reference points, the distance from the reference point to the target being measured by the angle (degrees or minutes) subtended at the eye. When describing a target bearing obliquely from a reference point, the "vertical clock method" will be used alone or in conjunction with the above. The angles as found can also be layed off at the gun by means of the direction and elevation dials.

Lateral measurements less than 15 minutes should not be given.

When the above system is employed, the line of sight of the gun is brought into the close vicinity of the target. The gun must then be layed on a definite aiming mark, which must be further described.

For the use of dials *see* Sec. 57.

4. The number of reference points selected will depend on the nature of the country, but, as a general rule, reference points at intervals of not more than 30 degrees should be selected. These points, if possible, should not be nearer to the gun position than the probable targets.

5. The angles are measured by means of graticuled glasses or cards, or by the angles as subtended by the various parts of the hand when placed at arm's length. All officers, N.C.Os. and men should know the "hand-angles," which vary with the individual.

For the purpose of instruction a degree scale, calculated for

given distance and painted on a wall, will be found useful. A more convincing method can be demonstrated by the use of the dial on the gun.

6. Landscape targets should be used for the preliminary lessons in the methods of describing targets, and to give practice in quick and accurate laying on the points described (see Sec. 25, Small Arms Training, Vol. I. 1924).

#### 10. Aiming instruction

The soldier must be instructed on the lines laid down in this section before he commences "sight setting and laying" in elementary gun drill.

1. Kit required: Gun, tripod, belt box, miniature bull's-eye target, figure and landscape targets.

2. The instructor should first impress upon the squad the importance of correct aiming, from the machine-gun point of view.

3. The use of the sights—to obtain direction and elevation—will be explained.

4. The method of adjusting the sights will be demonstrated and explained. Fifty yards will be taught as the smallest adjustment. The instructor should impress upon the men that the correct line on the graduated plate for any particular range is the one *under* the figures indicating that range. The men should be required to make several adjustments.

5. The following rules for aiming will then be given, and diagrams used to make the explanation clear:—

- i. Sights upright. This is obtained by correct mounting of the tripod (see Sec. 13, 7).
- ii. Master eye used.

iii. With the "U" pattern backsight, blade in centre of "U" and tip in line with shoulders. With the aperture pattern backsight, tip of the blade in centre of the aperture and directed at the target.

iv. The regulation "6 o'clock" aim will be taken—i.e., the lowest *visible* portion of the aiming mark.

v. With the "U" pattern backsight, eye about 6 inches from rear crosspiece. With the aperture pattern backsight, eye to be placed immediately over the rear crosspiece. Men should be instructed to look through the aperture and not at it.

6. A miniature bull's-eye target will then be placed about 10 yards away. The instructor will lay a correct aim without "holding." He will explain that direction is obtained by tapping the traversing handles, and that the elevating wheel must be turned in order to elevate or depress the gun. Whilst laying, the chin must be supported on the hand. A belt box may be placed across the knees and the elbows rested on the box, or the box may be placed on the ground, resting on end, and the arms resting on the top.

7. Every man should then view the aim, after which the men themselves, in turn, will lay the gun. They will not "hold" the gun during this lesson. The reasons for taking a regulation aim should be explained.

Should any faults be detected, the instructor will point out what effects they would have on shooting, and will see that such faults are remedied.

8. When sufficient progress has been made, the correct method of "holding" the gun will be shown and explained.



The following points in connection with "holding" should be impressed upon the men :—

i. The correct method of holding the traversing handles is with the third and little fingers round the handles, second finger behind the safety catch, forefingers on top, and thumbs resting lightly on the thumbpiece.

ii. The elbows should, whenever possible, be supported by the inside of the thighs.

iii. That there should be practically no difference in aim with or without holding.

9. When the men can aim correctly, using a bull's-eye target, similar practice will be given on figure targets, then on landscape targets, and finally on natural features in the open country.

A perfect aim must be insisted upon at all times.

10. The fixed sight is used up to 500 yards inclusive. The method of aiming with this sight is the same as with the aperture pattern backsight.

*Note.*—Faults in aiming can readily be pointed out as follows :—

The instructor holds a piece of white paper in front of the foresight, obliterating the aiming mark, and instructs the pupil to look along the sights, taking care that the foresight is kept in correct relation to the backsight; he then removes the paper for a few seconds while the pupil notes where the line of sight strikes the target.

### 11. Signals

1. The machine gunner will have received instructions during his recruit training in the signals laid down in *Infantry Training*, Vol. I.

The following machine-gun signals will be used for controlling movements and fire :—

"Action"—Both arms, fully extended, raised from the sides to a position in line with the shoulders and lowered again. This motion to be repeated until it is seen that the signal is being complied with.

"Cease firing."—Arm swung in a circular motion in front of the body.

"Gun ready to fire."—The No. 2 will extend his left arm horizontally.

"Stand by, ready to fire" or "Go on."—The controlling officer will raise his hand.

"Fire."—The controlling officer will drop his hand. The No. 2 will tap the No. 1 lightly on the back and order "Fire," and will then lower his left arm.

"Stop."—The controlling officer will wave his arm horizontally. The No. 2 will tap the No. 1 lightly on the back, and order "Stop."

2. The following semaphore code will be used to convey :—

#### i. Orders—

U	...	...	Up 50 yards (or up 10 mins.).
N	...	...	Down 50 yards (or down 10 mins.).
T	...	...	Right 30 mins.
L	...	...	Left 30 mins.

To double or further increase the above corrections, the code letter will be repeated as necessary.

ii. *Information—*

K	...	...	Fire observed correct.
Q	...	...	Fire unobserved.
B	...	...	More ammunition required.
W	...	...	More water required.
H	...	...	Limbers to come up to gun position.
A	...	...	Section, sub-section or gun-detachment commanders to join their immediate superior.

12. *Allocation of duties in the field*

1. *Infantry.*—The duties of a platoon commander are to direct the movements of and allot tasks to his sections in accordance with the orders of his commanding officer: to make any arrangements which may be necessary with regard to the supply of ammunition: to establish a headquarters in touch with battalion headquarters: to observe the progress of operations and inform his C.O. of any change in the tactical situation which may necessitate an alteration in the machine-gun dispositions.

2. The platoon serjeant will assist his platoon commander in supervising the ammunition supply to the sections, and in gaining and keeping touch with them. He will take charge of the platoon report centre, and move it in accordance with the orders of his platoon commander.

3. The section officers will move their sections and occupy positions with a view to carrying out the orders of the platoon

commander. They will be responsible for deciding whether section or sub-section positions will be taken up, in accordance with the tactical situation and the tasks they have to perform.

In the case of section positions they will select the area for the gun position, point out the arc of fire, and themselves control the fire of the four guns: in the case of sub-section positions they will not attempt to control fire, but will regulate the movements of and allot tasks to the sub-sections in accordance with the nature of events.

4. The sub-section serjeants each command a sub-section of two guns.

When a section position is being occupied, they will make a preliminary reconnaissance and then issue to their gun-detachment commanders the necessary orders for the occupation of the position. They will be responsible in action for the regulation of the chain of supply from limber to guns, and the correct performance of all duties by the gun detachments of their sub-sections. When working by sub-sections, their duties are to move their sub-sections in accordance with the orders of the section officer: to select and occupy positions suitable for carrying out the tasks allotted to them: and to control the fire of their two guns, and the movement of their limber.

5. The duties of a gun-detachment commander are as follows:—

He is responsible for the discipline, turn-out, equipment and drill of his detachment.

He issues orders, based on orders given by the sub-section commander, to his detachment. On the section being ordered into action, he is responsible for indicating the

position for his gun. After his gun is in action, when direct fire is being employed he will not, unless specially ordered, remain at the gun position but will generally supervise the work of his detachment, paying special attention to the chain of supply, replacement of casualties and prevention of unnecessary movement between the gun position and limbers. When indirect fire is being employed he will remain at the gun position and will be responsible that all orders issued by the fire-unit commander are acted upon correctly by the Nos. 1, 2 and 3 of his gun. He will himself adjust the clinometer and ensure that the required elevation is placed on the gun.

6. The following are the duties of the various numbers :—

No. 1 is the firer. He will personally clean and look after his gun, and ensure that the mechanism is working smoothly. On going into action he will carry the tripod and place it in position, and assist No. 2 in mounting the gun. He observes his own fire when possible, as well as the movements of our own troops and of the enemy. He will only make alterations of direction and elevation when ordered to do so.

No. 2 carries the gun into action and assists No. 1 to mount it. On going into action he will secure the condenser tube to the gun, and will carry the spare parts case. He will attend to the feeding of the gun, watch for signals from the controlling officer or N.C.O., and generally assist No. 1.

No. 3 is responsible for keeping the gun supplied with ammunition, seeing that the condenser (filled with water) reaches the gun position as soon as the gun is mounted, and for carrying out minor repairs whilst the gun is in action.

No. 4 assists No. 3 in his duties. He is responsible for

keeping No. 3 supplied with ammunition, water, oil and spare parts as required.

Nos. 5 and 6 are spare numbers to replace casualties and may be used to assist in belt-filling, brakesmen, orderlies, &c.

The scouts will, in accordance with the section commander's orders, carry out protective duties and their duties as ground scouts and observers.

The duties of the range-takers are :—(i) To take ranges and make range cards as directed by the section or sub-section commander; (ii) assist in observation of fire. The second range-taker will be in reserve.

Section officers will ensure that each man of the section is thoroughly trained in the duties of each "number."

7. *Cavalry*.—The squadron leader will command his squadron and be at all times responsible for its discipline, training and efficiency. He will further be responsible for the prompt and efficient carrying out of the regimental commander's tactical orders in accordance with the situation and the nature of the ground. He will at all times keep the regimental commander informed of the amount and power of the support he is able to afford him. He will also be responsible for the ammunition supply of his guns and ensure that an adequate service to this end is established and maintained. He will establish a report centre near or coinciding with regimental H.Q. and will always maintain touch with the regimental commander. Lastly, he will be responsible for the movements of the squadron transport if different from that of the regiment.

8. The serjeant on squadron H.Q. will be responsible for the actual detailed organization and working of the

squadron report centre. He will assist the squadron commander in organizing and supervising the ammunition supply.

9. Troop leaders will at all times be responsible for the efficiency of their troops in every respect and for their fire command in the field. In the case of officer troop leaders, each will be prepared to assume tactical and, on occasions, fire command of two or more troops in accordance with the task assigned on the orders of their squadron leader. Every troop leader is responsible for keeping squadron H.Q. informed of their ammunition expenditure and for taking the most rigorous measures at all times to restrict this expenditure to the lowest amount compatible with the efficient execution of the task allotted to them.

10. The second in command of a troop, whether a serjeant or a corporal, will have similar duties, *i.e.*, at all times to act as the representative of his troop leader in his absence, to be in charge of led horses when guns are in action and to take the place of his troop leader should the latter become a casualty. He will also be responsible for the correct working of the line of supply. When in charge of led horses he must be in touch with the gun position so as to be able to observe signals from his troop leader.

11. Corporals, where not otherwise employed, will act as assistants to the fire commander and ensure that his fire orders are correctly transmitted to each gun. In the case of indirect fire or night firing they will be responsible that the correct elevation and direction are put on the guns. Corporals when employed on transport duties will normally be in charge of one or more limbers. They will be responsible that all anti-aircraft precautions, feasible in the circumstances,

are taken. Whilst moving to the rendezvous indicated or in accordance with other orders received, they will make every use of the ground and natural features to conceal their advance. In action they will be responsible that all belt filling and repairs at the limber are carried out with the greatest despatch and returned to the firing line as soon as possible.

12. The following are the duties of the various numbers :—

No. 1 is the firer : he will also act as gun commander and will normally be a lance-corporal. In direct fire he will be responsible that the troop leader's fire orders are correctly put on the gun, and for the observation and reporting of his own fire up to 800 yards.

Only in close battle, when superior control is weakened and possibly lost, will he be responsible for correction of his aim on to the target. In indirect and night firing he will only be responsible for the correct carrying out of the orders he receives and for maintaining the correct laying of his gun. When out of action he will remain responsible for the gun and tripod and will report any defects in their condition or fitness. On going into action he will carry the tripod (less crosshead) and assist No. 2 to mount the gun.

No. 2 carries the gun into action and assists No. 1 to mount it. He carries the spare-parts case and is responsible for fixing condenser tube to the gun. He will attend to the feeding of the gun and watch for signals from the fire commander. He will always act as the assistant of No. 1.

No. 3 is responsible for keeping the guns supplied with ammunition and for seeing that the condenser reaches the gun position as soon as the gun is mounted. He is also responsible for minor repairs whilst the gun is in action and for passing down more serious ones to the base of the line of



supply. It must be emphasized that he must always be a reasonable distance from the actual gun position.

No. 4 assists No. 3 in his duties. He is responsible for keeping No. 3 supplied with ammunition, water, oil, and spare parts as required.

No. 5 will be trained as a range-taker. When not so employed, he will act under his troop leader's orders.

No. 6 will lead the gun-pack horse. In action he will take the horses of Nos. 1 and 2.

No. 7 will lead the 1st ammunition-pack horse. In action he will take the horses of Nos. 3 and 4.

No. 8 will lead the 2nd ammunition-pack horse. In action he will take the horse of any No. 5 not employed with the reconnaissance party.

In the officer's troop, the officer's batman will be the horse-holder of the troop leader.

In the serjeant's troop the farrier will take the horse of the troop leader.

*Note.*—Owing to differences between peace and war establishments, the following alterations are necessary in peace :—

No. 7 of every second team will be without a pack horse. He will act under his troop leader's orders.

Nos. 8 will not have pack horses. They will act under their troop leader's orders.

Nos. 9 will act under their troop leader's orders.

## CHAPTER III

### MACHINE-GUN DRILL

#### 13. Elementary gun drill

1. Elementary gun drill will consist of the following :—

- i. Mounting the gun.
- ii. Dismounting the gun.
- iii. Loading.
- iv. Unloading.
- v. Coming into action.
- vi. Sight setting and laying.
- vii. Ceasing fire.
- viii. Traversing and searching.

In order that training may be progressive this sequence should be adhered to.

#### 2.—Kit required for each gun detachment.

Gun, Mark IV tripod, belt box with belt and dummies, spare parts case complete, condenser and tube,\* landscape

\* NOTES.—1. On all occasions during training, except when firing, a dummy condenser tube should be used to prevent the metallic tube from being damaged. The dummy tube can be made by attaching a union joint to a 6 feet length of 1½-in. rope.

2. The condenser normally will consist of a water can. For units which still retain the condenser bag, where reference in this manual is made to "condenser" read "condenser bag."

target (if natural panorama is not available) and targets for Part I of the Annual Machine-gun Course.

### 3.—Laying out of kit.

- i. The gun and tripod will be placed in line on the ground, about 3 paces apart and about 30 yards from the landscape target.
- ii. Tripod on the left, legs to the rear.
- iii. Gun on the right, muzzle pointing to the front, condenser tube fitted.
- iv. Spare parts case alongside and on the right of the gun.
- v. The belt box and condenser about 3 paces in rear of the interval between gun and tripod.

### 4.—“Fall in.”

On the command “Fall in” each detachment will fall in, in single rank, and stand to attention about 5 paces in rear of the kit. (Plate I.)

### 5.—“Number.”

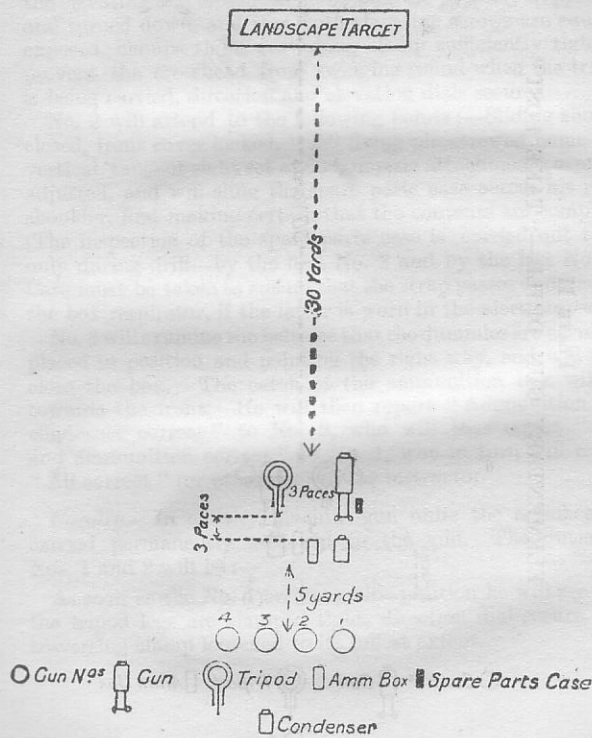
On the command “Number,” the detachment will number as in squad drill. The detachment will be cautioned that the No. 2 will convey all signalled orders to No. 1.

### 6.—“Take post.”

On the command “Take post” the gun detachment will move at the double to positions as follows:—No. 1 will fall in on the left of the tripod. No. 2 will fall in on the right of the gun. No. 3 will fall in on the left of the ammunition box. No. 4 will fall in about 5 paces in rear of No. 3, and on his

### PLATE I

### ELEMENTARY GUN DRILL.—“FALL IN”



No. 2 will attend to the following points:—Sliding shutter closed, elevating gear closed up, front cover locked, "T" fixing pin screwed home and vertical, tangent sight set at 600, muzzle attachment correctly adjusted, crosshead and elevating joint pins are properly in position and turned down, and will sling the spare-parts case across his right shoulder, first making certain that the contents are complete.

#### 7.—"Mount gun."

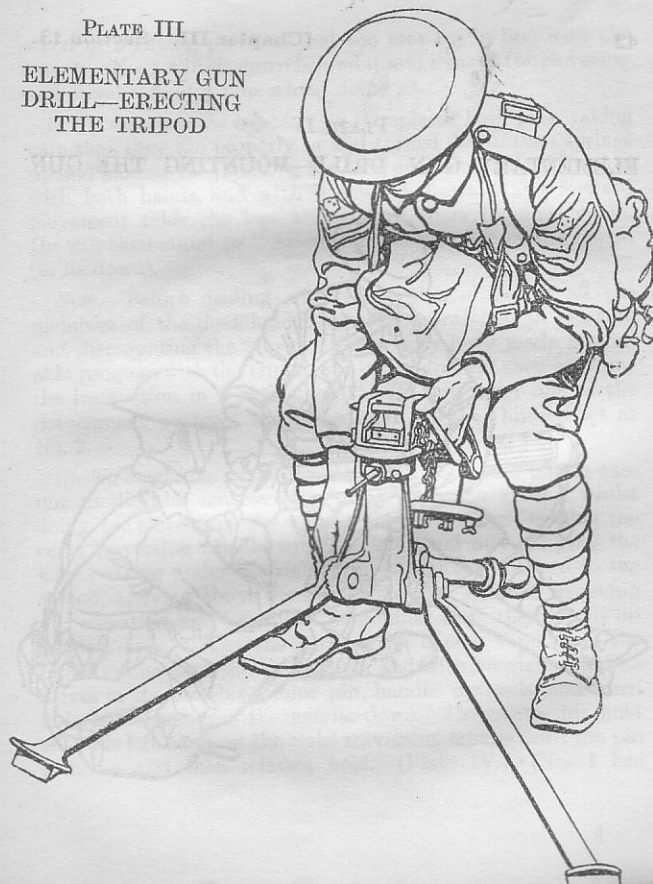
*Note.*—The instructor will now bring the detachment to the left of the position where the gun is to be mounted, so that they may see all movements clearly and listen to explanations. He will then act as No. 1 himself, giving the order "Mount gun," and will point out a position, which will be about 25 yards from the target, where the gun is to be mounted.

i. *To erect the tripod.*—On the command "Mount gun," No. 1 picks up the tripod, doubles forward to the position indicated, places it on the ground and, standing astride rear leg, loosens jamming handles simultaneously with both hands, grasps crosshead bracket with both hands and with forward and upward movement erects tripod. Whilst adjusting it the following points must be attended to: the crosshead bracket should be held by the left hand, close to the socket, the left fore-arm being supported by the left thigh, rear leg on ground, and both the jamming handles should, if possible, be manipulated with the right hand. (Plate III.)

When the tripod is mounted the socket must be upright, the clamps tight, the tripod a convenient height for the firer

#### PLATE III

#### ELEMENTARY GUN DRILL—ERECTING THE TRIPOD



## PLATE IV

## ELEMENTARY GUN DRILL—MOUNTING THE GUN



when in a sitting position, and the rear leg in line with the target. No. 1 will sit down behind it and remove the elevating and crosshead joint pins whilst doing so.

ii. *To dismount the tripod.*—No. 1 replaces both pins, taking care that they are properly in and turned down, then springs up and loosens the jamming handles, grasps crosshead bracket with both hands, and with backward, upward and forward movement folds the legs and clamps them together again. He will then stand to "Attention" on the left of the tripod (or lie down).

*Note.*—Before dealing with the action of No. 2 all the members of the detachment should be practised in erecting and dismounting the tripod. When they have made reasonable progress with the tripod, the instructor will then continue the instruction in "Mount gun." He will order one of the detachment to erect the tripod and will then himself act as No. 2.

iii. *To mount the gun.*—No. 2 picks up the gun, taking care not to dig the muzzle attachment into the ground whilst doing so, and opens the sliding shutter. Then, holding the right traversing handle with the left hand and carrying the barrel casing under the right arm, he doubles forward to the tripod, arriving about the same time that No. 1 is removing the elevating and crosshead joint pins. He then kneels on his left knee, places the gun on the tripod, supporting the barrel casing with the right thigh, and with his right hand he drives in the crosshead joint pin, handle upwards, and when it is home he turns the handle down. He retains his hold with his left hand on the right traversing handle until the pin is home and then releases hold. (Plate IV.) (No. 1 has



meanwhile grasped the left traversing handle with his left hand.) No. 1 similarly puts in the elevating joint pin and turns it down.

No. 2 then lies down on the right of the gun, places the belt box in position in line with the feed block, and sees that the strap on the box is clear of the lid, or, if a metal box is used, that the quick release strap is disengaged. He also inserts the tube into the condenser after the latter has been brought up by No. 3.

After putting in the elevating joint pin, No. 1 will at once level the gun, test the traversing clamp to see that it is "sticky," and then sit with elbows resting inside the thighs and holding the traversing handles correctly. Eyes must be directed towards the target and not at his hands or gun.

*Note.*—In cavalry machine-gun units the above drill is carried out as follows:—

i. *To erect the tripod.*—On the command "Mount gun" the No. 1 will erect the tripod by loosening the clamps of the two front legs, holding the socket with the left hand and the rear leg with the right hand.

When the legs are in position it will be adjusted with the socket upright by resting the left forearm on the left thigh, and manipulating both the jamming handles with the right hand.

When the tripod is mounted the No. 1 will sit down behind it.

ii. *To dismount the tripod.*—No. 1 will loosen the jamming handles of the two front legs of tripod, fold up the legs, tighten the jamming handles and lie down.

iii. *To mount the gun.*—No. 2 picks up the gun, then holding the right traversing handle with the left hand and carrying the barrel casing under the right arm he will place the pivot into the socket and lie down.

He then clamps the traversing clamp. Meanwhile No. 1 will have levelled the gun and opened the sliding shutter.

No. 2 places the belt box in position in line with the feed block and will see that the strap on the box is clear of the lid. He will also insert the tube into the condenser.

The instructor will then act as No. 3.

No. 3 will double forward with the ammunition box and condenser and place them conveniently for No. 2—i.e., the catch (or quick release strap) towards the gun and the box placed in such a position that No. 2 is not likely to knock it over as he lies down. The ammunition box and condenser must be at hand directly No. 2 is ready for them.

No. 3 then doubles back to his original position.

When the gun is mounted and the Nos. 1, 2 and 3 are in position, the following points should be criticised by the instructor:—

- (a) Actions of Nos. 1, 2 and 3 until the gun is mounted.
- (b) Rear leg of the tripod in line with the target.
- (c) Shoes, not legs, of the tripod on the ground.
- (d) Jamming handles tight.
- (e) Socket upright.
- (f) Traversing clamp sticky.

*Note.*—This must be tested by the instructor in the same way that the No. 1 tests it—i.e., by tapping the traversing handle.

- (g) Pins properly in and turned down.
- (h) Elevating screws equally exposed.
- (i) Elevation dial secure.
- (j) Tripod a suitable height for the firer.
- (k) Gun level and pointing towards the front.
- (l) Condenser tube fitted and in condenser.
- (m) Front cover locked.
- (n) Sliding shutter open.
- (o) Tangent sight slide at 600 yards.
- (p) No. 1 sitting and holding the gun correctly.
- (q) No. 2 lying down, with his head below the level of the gun, spare parts case slung across his shoulder, with strap underneath the box respirator if worn in the alert position.
- (r) Belt box in correct position, with the strap clear of the lid; or, if a metal box is used, with the quick-release strap disengaged.
- (s) No. 3 lying down in rear.

*Note.*—When the instructor criticises, the faults each number has committed should be pointed out to the whole detachment.

During the drill the instructor will give the command "Fall out 1, 2 or 3," as the case might be, and the duties of the number fallen out will be performed by the next number; the whole detachment will renumber.

#### 8. "Dismount gun."

The instructor will demonstrate the duties of each number in turn.

On the command "Dismount gun," No. 1 will remove both pins, and as soon as No. 2 has removed the gun, he will replace both pins, stand up, loosen the jamming handles, fold up the legs and tighten the jamming handles, and, if necessary, align the crosshead arm over the rear leg.

No. 2 will push the belt box away from the tripod and lift the gun from the tripod. Before placing the gun on the ground he will close the sliding shutter. He will finally reset the sight at 600 yards if necessary.

No. 3 will double forward, seize the belt box and condenser and carry them back to the original position. Should the box be fitted with quick release strap he will see that it is fastened.

*Note.*—In cavalry machine-gun units the drill will be:—

On the command "Dismount gun," No. 1 will close the sliding shutter and elevate the gun to its fullest extent. Meanwhile No. 2 will have unclamped the traversing clamp to its fullest extent and turned the crosshead joint pin up. No. 2 will now lift the gun and crosshead clear of the mounting, place them on the ground, reset the sights at 600, if necessary, and lie down.

As soon as No. 2 has removed the gun, No. 1 will loosen the jamming handles of the two front legs of tripod, fold up the legs, tighten the jamming handles and lie down.

#### 9. "Load."

The instructor will act as the No. 1 and then as the No. 2, the detachment standing near the gun.

On the command "Load," No. 1 pulls the crank handle on to the roller with the right hand, and advances his left hand to the left of the feed block, ready to grip the belt.

No. 2 opens the belt box, holds the end of the belt (at the point where the brass tag joins the fabric) with his forefinger (right hand recommended) along the tag, and pushes the tag through the feed block as far as possible.

*Note.*—With the metal belt boxes, both halves of the lid will be opened. One half may be closed later if necessary.

No. 1 grips the tag, and pulls the belt through the feed block as far as possible. He must pull the belt *slightly* to his left front when doing so. He then releases the crank handle, taking care not to allow his right hand to move forward with it. He again pulls the crank handle on to the roller, pulls the belt slightly to his left front, and releases the crank handle. Whilst pulling the crank handle on to the roller the belt will be held (but not pulled) with the left hand. He then resumes his holding on the gun.

*Note.*—The instructor should explain that the pulling of the belt slightly to the left front is only to avoid the natural tendency to pull it to the rear, *i.e.*, towards the No. 1, and that to pull the belt too much to the left front, or with much force, must be guarded against.

#### 10. "Unload."

*Note.*—The instructor will perform the duties of No. 1 and then of No. 2, the detachment standing near the gun.

On the command "Unload," No. 1 will pull the crank handle on to the roller, and immediately allow it to fly forward again. Should the tangent sight be up, it will be lowered at the same time with the left hand. He will repeat this movement. He will then press the top and bottom pawls of the feed block with the right hand, the top pawls being pressed with the fingers, and the bottom pawls with the thumb, taking care

to keep the hand clear of the entrance to the feed block. No. 2 will withdraw the belt and pack it carefully in the box. When the last round is clear of the feed block No. 1 will press the thumbpiece with the left hand. The wooden box must be locked, but with the metal box the lids need only be closed, not locked.

*Note.*—All numbers should now be practised in loading and unloading until reasonable progress is made. Should any man exhibit a tendency to slur the loading motions, it may be advisable to make him load "by numbers," counting aloud whilst doing so.

#### 11. "Action."

When the men have made sufficient progress in the foregoing lessons, they will be exercised in coming into "action." The instructor will define the "arc of fire," and give the command or signal "Action." The gun will then be mounted and loaded, after which the various points taught in previous lessons will be criticised.

#### 12. To adjust the sights.

*Note.*—Before this lesson and the next are dealt with, instruction in aiming must have been given. (Sec. 10.)

On the range being given, No. 1 will raise the tangent sight (unless the range is 500 yards or under, when the fixed sight will be used), and adjust the slide to the range ordered.

#### 13. To lay the gun.

On the target being indicated by the instructor, No. 1 will tap the gun over until the correct direction is obtained, and elevate or depress until the aim is correct. Should a large

*Note.*—After the order “Stop,” no gun will fire again until the order “Go on” is given.

#### 17. “Cease firing.”

The gun will be unloaded and dismounted on the spot.

On service No. 3 might not be required, Nos. 1 and 2 dealing with the belt box or boxes and condenser, as circumstances suggest.

#### 18. Traversing.

The gun will be mounted 25 yards from the target, as used in the Annual Machine-gun Course, Part I, before instruction begins; and the fact that the bull's-eyes are four inches apart must be pointed out to the men.

The instructor will explain that the object of the exercise is to develop a consistent, automatic tap, and to teach the degree of tightness required in the traversing clamp, in order that the line of sight may be displaced fifteen minutes each time the gun is tapped.

The following points will then be explained :—

- i. A strong tap with a tight clamp is much preferable to a weak tap with a loose clamp.
- ii. When tapping with either hand, the gun must be held correctly with the other hand, and the safety catch kept raised.
- iii. Eyes must be directed at the target the whole time, and not at the rear end of the gun or along the sights, except momentarily for checking the aim.
- iv. If the gun moves too much or too little, the *traversing clamp* must be altered, *not* the tap.

Between each tap, the thumb-piece will be pressed for not less than two seconds, which is the time required to fire a group of 10 to 20 rounds.

The instructor will then show how to test the traversing clamp, and give a demonstration of traversing. All numbers will then be exercised, tapping with the left as well as with the right hand; the tangent sight will be raised, but not used, during the exercise.

#### 19. Searching.

The gun will be mounted 25 yards from the target as used in the Annual Machine-gun Course, Part I.

The instructor will explain that the object of the exercise is to train men to turn the wheel so that the line of sight is displaced up or down fifteen minutes for every turn, which will ensure the overlapping of beaten zones approximately at all ranges.

The following points will then be explained :—

- i. The wheel will be manipulated with the right hand only.
- ii. The wheel must be grasped firmly and turned boldly —not hesitatingly.
- iii. Eyes must be directed at the target whilst the wheel is being turned.

*Note.*—Whilst learning, the men should be allowed to look along the sights, so that they may realize how much the wheel ought to be moved.

Between each turn of the wheel, the thumb-piece will be pressed for not less than 2 seconds, which is the time required to fire a group of 10 to 20 rounds.



The instructor will give a demonstration, the men afterwards being exercised.

#### 20. Oblique traversing.

The gun will be mounted 25 yards from the target as used in the Annual Machine-gun Course, Part I.

The instructor will explain that the object of the exercise is to train men in combining traversing with the manipulation of the elevating wheel.

The following points will then be explained :—

- i. The correct sequence of action must be followed, i.e., fire, tap, elevate (or depress).
- ii. The tapping must be automatic as in ordinary traversing.
- iii. When elevating or depressing the gun, the sights must be used.

It is apparent that the greater the angle which the line to be traversed makes with the horizontal, the greater will be the turn necessary, to bring the sights on to the mark after traversing, and *vice versa*. The turn in this case must not be confused with the 15-minute turn in the previous lesson.

The instructor will give a demonstration, after which all the men will be exercised.

#### 21. Swinging traverse.

The gun will be mounted 25 yards from the target as used in the Annual Machine-gun Course, Part I.

The instructor will explain that this method of traversing is employed against linear targets only at very close ranges, when the normal method of traversing is likely to prove too slow.

The following points will then be explained :—

- A certain amount of "stickiness" is advisable from the point of view of control, the vibration of the gun rendering it easy to swing.
- ii. The gun must not be moved by a movement of the forearms only. The upper part of the body should be fairly rigid, and the gun should be moved by forcing the upper part of the body over to the opposite side to which it is desired to traverse.
- iii. The rate of movement should be such that the line of sight is moved about 1 yard in 2 seconds, when the target is 25 yards from the gun. The movement of the gun is almost imperceptible.
- iv. The thumb-piece should be pressed at the same time as the gun begins to move.

The instructor will give a demonstration, after which all the detachment will be exercised. The importance of the crosshead being upright must be emphasized.

#### 14. Ranging drill

1. The object of this drill is to inculcate a logical sequence to enable the fullest value to be obtained from the rounds allotted to the ranging practices of the Annual Machine-gun Course.

2. Quick and accurate ranging necessitates the following sequence :—

- i. Obtaining direction and elevation by means of the sights prior to opening fire.

- ii. Alteration by the elevating wheel and tapping, between bursts of fire, without reference to the sights.
- iii. Adjustment of the sights, without displacing the gun (*i.e.*, registering), when the elevation is seen to be correct.

3. The above sequence is best taught by means of a landscape target in the following manner:—

- i. *To teach obtaining, correction and registration of elevation.*—The instructor will order the firer to lay on some object on the landscape target with a given elevation. When this has been done the order to fire will be given.

The instructor will now indicate the supposed position of the shots above or below the point aimed at. The firer will then depress or elevate the gun by means of the elevating wheel until the line of sight is the same distance above or below, as the shots were indicated below or above the target.

The instructor will now check the new point of aim, and, if correct, inform the firer that the shots are now striking the target.

Should the aim be incorrect, the instructor will indicate the new position of the shots having regard to the actual position of the line of sight. The firer will then correct his point of aim until the shots are reported correct by the instructor.

After the shots have been reported correct, the firer will “register” automatically, *i.e.*, he will

adjust the tangent sight slide so as to bring the line of sight on to the target, and inform the instructor as to the elevation required to hit the target.

When the fixed sight is used, registration will consist of locating and describing a gun aiming mark above or below the target.

- ii. *To teach obtaining, correction and registration of direction.*—As in (i), the instructor will order a target and range. He will then indicate the supposed position of the shots, the firer deflecting his line of sight until the instructor, after checking the line of sight, informs him that the shots are striking the target.

- iii. *To teach the combination of (i) and (ii).*—In these lessons the firer will be required to obtain the correct elevation and direction as described above. After registering, he will inform the instructor as regards the elevation and gun aiming mark required in order to hit the target.

### 15. Tests of elementary gun drill

1. The following tests have been devised to assist officers in testing the efficiency of their men in elementary gun drill, and also to ensure that no detail of such training is overlooked. It is important that these tests should not be considered solely as competitions against time, for although quickness is necessary, accuracy is the first essential. No man should, therefore, be passed as efficient unless all the points are properly fulfilled, even though he may complete them in the standard

time. Men who, whilst passing the test for accuracy, slightly exceed the standard time, should be tested again before being put back for further instruction.

The nature of tests vii, viii and ix renders it inadvisable to lay down a standard time.

2. The tests must be carried out in strict accordance with the detailed instructions given, for unless the smallest details are insisted upon, the time limit will not be applicable. In carrying out these tests, time can be saved if the first pair complete tests 1 to 5 consecutively; the remainder can be carried out as convenient.

3. The entire personnel of a machine-gun platoon, including the drivers when possible, should qualify in these tests, acting both as No. 1 and No. 2. This is necessary, for on service any member of a platoon may be required to replace a casualty at a moment's notice. The No. 1 should not be failed when, owing to the fault of No. 2, the time limit is exceeded. He must be tested again with a fresh No. 2.

4. No man will fire the Annual Machine-gun Course until he has correctly passed these tests of elementary gun drill. A record of these tests will be kept by each section commander and produced for inspection by the platoon commander as required.

5. The tests are as follows:—

i. **To erect the tripod and mount the gun on the command "Mount gun."**

Nos. 1, 2 and 3 will take post, lying down if the ground permits. The position where the gun is to be mounted to be not more than 5 yards away.

*Points to be observed.*—All the points given in Sec. 13, 7.

*Standard time:* 20 seconds.

ii. **To load the gun on the command "Load."**

Belt with a few dummy rounds at the end, properly packed in the box, which will be closed.

*Points to be observed.*—The gun to be correctly loaded; all loading motions to be quite distinct and correct, and to be carried out without any slurring.

*Standard time:* 5 seconds.

iii. **To unload the gun on the command "Unload."**

*Points to be observed.*—Gun unloaded, tangent sight lowered, unloading motions to be quite distinct, belt withdrawn and repacked carefully in the box with lid closed; lock spring released.

*Standard time:* 5 seconds.

iv. **To dismount the gun on the command "Dismount gun."**

The gun will be dismounted on the spot.

*Points to be observed.*—All the points as when "All correct" is reported before mounting gun.

*Standard time.*—15 seconds.

v. **To bring the gun into action on the command "Action."**

This test combines (i) and (ii). It should therefore not be applied until proficiency has been attained in each of those tests.

*Points to be observed.*—All points as laid down for tests (i) and (ii). When No. 1 is ready to receive fire orders, No. 2 will hold up his hand.

*Standard time:* 25 seconds. The time will be taken from the command "Action" until No. 2 raises his hand, indicating that the gun is loaded.

vi. **To adjust the sights and lay the gun on the command " (Range)—(Target). "**

Gun loaded and ready to be layed. Three service targets will first be pointed out, but the No. 1 being tested will not know which is to be given. Any range may be ordered.

*Points to be observed.*—That the slide is adjusted and the gun layed with absolute accuracy.

*Standard time:* 12 seconds.

The time will be taken from the range being ordered until No. 2 holds up his hand, indicating that No. 1 is ready to open fire.

vii. **Horizontal traversing. On the command " Fire," e.g., " 450—Horizontal row—From left bull's-eye—To right bull's-eye—Traversing—Fire. "**

The target will be as for the Annual Machine-gun Course, Part I, placed at 25 yards from the gun. The gun will be layed on any bull's-eye that may be ordered. The tangent sight will be raised, but the firer must keep his eyes directed at the target during the traverse. The tests will comprise traversing from RIGHT to LEFT, as well as from LEFT to RIGHT. When the gun is layed, the aim should be checked by the officer conducting the test. On the command

" Fire," No. 1 will fire a group at the bull's-eye named, then traverse, so that the next group will be fired at the next bull's-eye and so on. The test will not be completed until the space between nine bull's-eyes has been traversed. In order to ensure that the traversing is satisfactory throughout, the order to stop will be given at least once during the traverse, but not before five groups have been fired, and the laying will be checked; this will be repeated when the limit of the traverse is reached.

*Points to be observed.*—That No. 1 tested his clamp before beginning the test; the object is to test if No. 1 has acquired the correct automatic tap. Tapping backwards to correct errors will not be allowed. By counting the number of taps, the correct point of aim can be calculated.

viii. **Searching. On the command " Fire," e.g., " 450—Right vertical row—From bottom bull's-eye—To top bull's-eye—Searching—Fire. "**

The target will be as for the Annual Machine-gun Course, Part I, placed at 25 yards from the gun.

The procedure will be as for (vii), "Searching" being substituted for "Traversing." The tests will comprise searching up and searching down.

*Points to be observed.*—The object is to test if No. 1 has acquired the correct automatic turn of the wheel. Turning the wheel backwards, to correct errors, will not be allowed. By counting the number of turns, the correct point of aim can be calculated as in (vii).



ix. **Oblique traversing.** On the command "Fire," e.g., "450—Oblique row—Left bull's-eye—To right bull's-eye—Traversing—Fire."

The target will be as for the Annual Machine-gun Course, Part I, placed at 25 yards from the gun.

The procedure will be as for (vii), but in this test manipulation of the elevating wheel is included and the firer is allowed to look along his sights. The tests will comprise traversing from RIGHT to LEFT, as well as from LEFT to RIGHT.

*Points to be observed.*—As in test (vii).

#### x. Immediate action.

In this test the man will be required to rectify correctly each of four different stoppages within a reasonable time. The officer superintending the test must ensure that the immediate action is correctly performed without any unnecessary delay.

A target should be indicated to the whole squad previous to the test. The crank handle should be covered with a cloth to conceal its position. On the removal of the cloth for covering the crank handle, the No. 1 will perform the immediate action.

#### xi. Belt filling.

A heap of 25 rounds of ball ammunition will be placed beside a man, and these will be inserted correctly in a belt.

*Standard time*—1 minute.

*Points to be observed.*—Rounds to be placed in a heap and not arranged. Inspection of the belt on completion will show if it has been filled correctly.

#### 16. Gun-detachment training

1. When the men have passed the tests of elementary gun drill they will be taught to work as a gun detachment. This will mainly consist of the following:—

- i. Mounting the gun on varying types of ground.
- ii. The use of ground and cover.

Before this training is carried out, a demonstration should be given in the use of cover from view, both natural and artificial, followed by practice in concealing gun positions.

2. *Mounting and dismounting the gun in the lowest position.*—The men will first be taught how to bring the gun into action with the tripod mounted in the lowest position.

The system of instruction will be as described in all the earlier lessons. It will be explained that the low position may be necessary when only low cover, or none at all, is available. The instruction will be divided into three stages.

##### (a) 1st Stage.

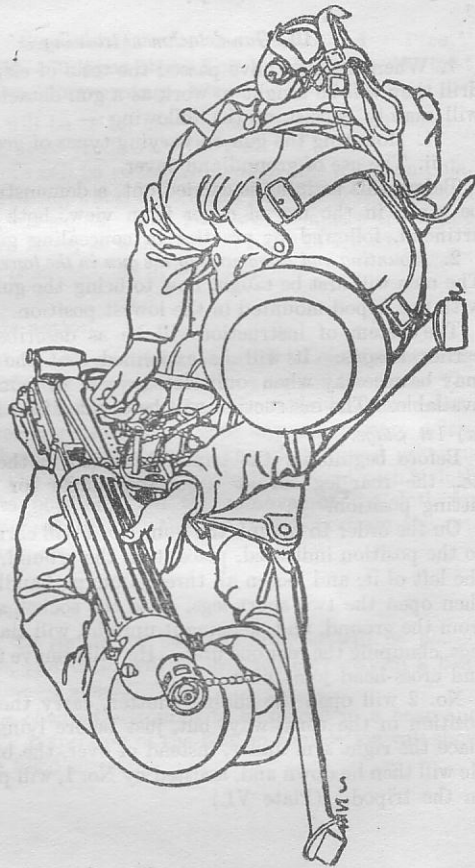
Before beginning, the tripod is folded in the usual way, i.e., the rear leg set at a suitable angle for the normal sitting position.

On the order to mount the gun, No. 1 will carry the tripod to the position indicated, place it on the ground, lie down on the left of it, and loosen all three jamming handles. He will then open the two short legs, raise the socket about 1 inch from the ground, and, keeping it upright, will clamp all three legs, clamping the rear one first. He will remove the elevating and cross-head joint pins.

No. 2 will open the sliding shutter, carry the gun to the position in the usual way, but, just before lying down, will place the right arm under, instead of over, the barrel casing. He will then lie down and, assisted by No. 1, will place the gun on the tripod. (Plate VI.)

## PLATE VI

GUN-DETACHMENT TRAINING—LOWEST POSITION—MOUNTING GUN



## PLATE VII

GUN-DETACHMENT TRAINING—LOWEST POSITION



No. 1 will put in a cross-head joint pin. No. 2 will put in the elevating joint pin. No. 3 will bring up the belt box and condenser in the usual way.

When the gun is mounted, No. 1 will lie with both legs on the left of the tripod, right leg crossed over left, his back being supported by the right thigh of No. 2, and his neck being supported by the left knee of No. 2. (Plate VII.).

When the gun is mounted, the usual points will be criticised, and, in addition, note should be taken that the shoes of the tripod and not the tubular portions of the legs are resting on the ground, and that the jamming handle of the rear leg does not interfere with the elevating wheel.

The gun will be dismounted in the usual way, except that all movements, prior to carrying the gun and tripod to the original position, will be carried out in the lying position.

#### (b) 2nd Stage.

Before beginning, the rear leg of the tripod is set and clamped at an angle suitable for the lowest position.

The instruction will follow the same lines as in the first stage. It will not be necessary to loosen the jamming handle of the rear leg on reaching the position.

#### (c) 3rd Stage.

Before beginning, the rear leg of the tripod is set at an angle suitable for the lying position, and then, in addition, the two front legs, instead of being folded alongside the rear one, are swung forward and upward, pointing in the air.

The instruction will follow the same lines as in the second stage.

3. *Training on rough ground and use of cover.*—The object of this training is to practise the detachment in bringing the gun into action on rough ground. Practice will be given in mounting the gun on a steep slope, firing in any of the following directions:—

- i. To the front or rear.
- ii. To the right or left.
- iii. Up hill.
- iv. Down hill.

The instruction will be divided into two stages as follows:—

#### (a) 1st Stage.

In this stage no targets are indicated, and the use of cover is not practised.

The instructor will show how the tripod is erected for all kinds of slopes and he will point out that:—

- i. The rear leg must always point downwards if the slope is very steep.
- ii. The socket must be upright.
- iii. Only the shoes of the tripod must touch the ground.

Each member of the detachment will then be exercised in erecting the tripod on a different position.

The instructor will then demonstrate the duties of No. 2 by mounting the gun on the tripod so as to fire in the required direction. He will demonstrate the means of placing the belt box so as to ensure a correct feed.

Each member of the detachment will then be exercised in mounting the gun on the tripod to fire in different directions. (Plates VIII and IX)

PLATE VIII  
GUN-DETACHMENT TRAINING—GUN FIRING ALONG A STEEP  
SLOPE

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[Chapter III. Section 16.]

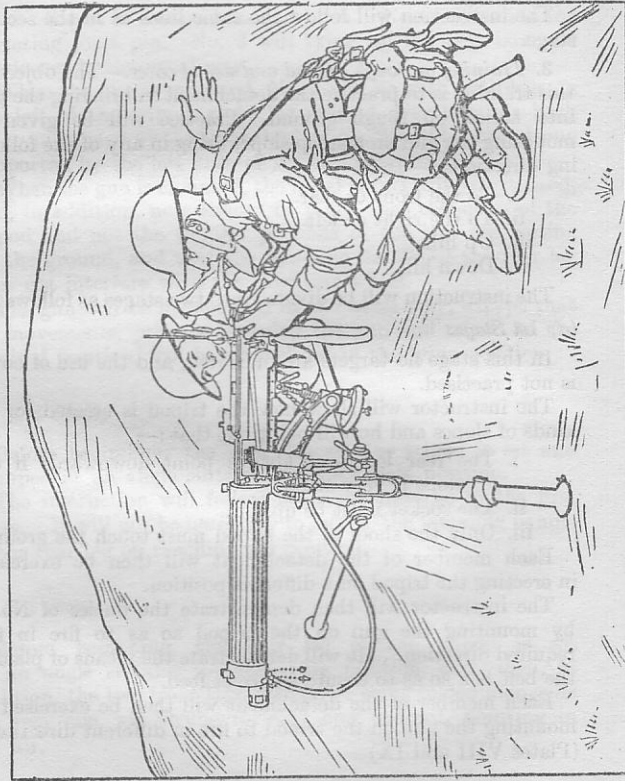


PLATE IX  
GUN-DETACHMENT TRAINING—GUN FIRING DOWN A STEEP  
SLOPE

Chapter III. Section 16.]

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*Note.*—It is often more convenient after the tripod has been erected, but before the crosshead is swung round in the direction of the target, to have the gun mounted, and then swung round. By doing this the task of No. 2 is easier than when the gun is mounted *after* the crosshead has been turned.

(b) *2nd Stage.*

In this stage an arc of fire will be given, the front indicated, and full use made of cover.

Nos. 1, 2, 3 and 4, with the gun, tripod, &c., will be in a position in readiness, not more than 10 yards from the selected gun position. The remaining numbers will be sent out as observers in the direction of the front and will criticise the movements of Nos. 1 and 2 as regards exposure when coming into action.

The instructor will mark a gun position, give the arc of fire, indicate the front, and then order "Action."

4. The following points should be criticised after No. 2 has raised his hand to indicate that the gun is in action :—

- i. Whether there was any unnecessary exposure whilst the gun was being brought into action.
- ii. Whether the gun is properly in action, and all the details of elementary training have been observed.
- iii. Whether the fire would clear any existing obstruction.
- iv. The correct erection of the tripod, with the rear leg downhill if necessary.
- v. Whether the tripod had to be altered after the gun was mounted.
- vi. The positions adopted by Nos. 1 and 2 as regards exposure and comfort.

- vii. The position of the belt box to ensure correct feed.
- viii. The position of the condenser with tube inserted.
- ix. The position of No. 3 (minimum exposure, within view of the gun, and within reach of ammunition supply).
- x. The position of No. 4.

When the men have made sufficient progress in the above, they should be practised in arranging and clamping, under cover, the position of all three legs (before mounting), so that the socket will be upright when the tripod is mounted on the position indicated.

### 17. Fire orders

1. Before fire orders can be practised, a high standard of training must have been reached in the subjects contained in the previous sections of this chapter. In addition, officers and N.C.Os. must possess a sound knowledge of fire direction. A fire order is the final précis of the solution of a fire control problem, and contains the instructions to the Nos. 1 to put the correct *elevation* and *direction* on their guns in order that their fire may fall on a desired point or area.

In direct fire, fire orders will be given by the fire-unit commander in a series of short sentences. The Nos. 2 will acknowledge receipt at the gun to the sub-section commanders by raising the hand.

When the section is the fire unit, sub-section commanders will signal when both their Nos. 1 have received each part of the order.

When guns are ready to fire, Nos. 2 will hold up their hands as in elementary drill, and when the section is the

fire unit, sub-section commanders will do likewise, when both guns are ready.

Fire-unit commanders should place themselves up wind whenever possible, but when the sub-section is the fire unit, control will be easier from the left of the guns so that Nos. 2 can see the signals.

In indirect fire, the gun-detachment commander will be at the gun and orders are addressed to him. He will acknowledge in the same manner as above.

## 2. Sequence in delivery of fire orders.

### i. Direct fire.

*Orders to open fire :—*

- (a) Range or ranges.
- (b) Indication of aiming point or points.
- (c) Nature of fire—  
     "Traversing."  
     "Distribute."  
     "By sub-sections distribute."  
     "By sub-sections inwards traversing."  
     "Inwards traversing."
- (d) Side wind allowances in taps right or left.
- (e) Executive order to fire.

*Orders during firing :—*

- (f) Deflection (e.g., "right two taps").
- (g) Elevation (e.g., "up a hundred").

### ii. Indirect fire.

*Orders to open fire :—*

- (a) Angle of switch from zero.
- (b) "Out target posts."
- (c) "Distribute" or "Concentrate."

- (d) Elevation or elevations.
- (e) "Load."
- (f) "Check."
- (g) Side wind allowances in minutes.
- (h) Executive order to fire.

*Orders during firing :—*

- (i) Deflection (e.g., "right 30 minutes").
- (j) Elevation (e.g., "up 30 minutes").

*Note.*—When degrees or minutes are incorporated in a verbal order, they should be given out by separate numerals, e.g., "Five seven degrees," not "Fifty seven degrees"; "two owe degrees" not "twenty degrees."

iii. Whenever possible anticipatory orders, in which the range and target are given before the occasion for firing arises, should be given to the gun-detachment commanders.

### iv. Position of the commander.

The position of the commander should enable him to :—

- (a) Observe the movements or position of our own troops.
- (b) Control fire.
- (c) Observe the movements of the enemy, or the target.
- (d) Observe fire.

v. *Training.*—Fire orders demand on the part of the commander quick appreciation of the nature and volume of fire required, good "indication" and skilful observation of fire whenever possible.

Constant practice is necessary, and failure to obtain fire effect with trained personnel is a reflection on the commander.

Training must ensure all types of targets being engaged :—

- (a) Targets of limited width and depth.
- (b) Targets possessing considerable depth but little width.
- (c) Linear targets.
- (d) Oblique linear targets.
- (e) Areas.

### 3. Execution of fire orders.

Careful training will be required in the execution of orders involving the use of traversing, distribution and overhead fire.

#### 18. Sub-section and section drill

1. This drill consists of :—
  - i. Sub-section drill.
  - ii. Section drill.
  - iii. Loading and unloading limbers and "Action" from limbers.
  - iv. Pack-saddlery drill.

Instructions in machine-gun signals (Sec. 11) will be given before sub-section drill is carried out, and these signals should henceforth be used whenever possible.

During the drill, a gun-detachment commander will supervise each gun detachment. The gun-detachment commander will take times and carefully note the performance of each movement; he will not assist the gun detachment, nor give any instructions unless so ordered. Gun detachments will always be numbered from the right. When the state of the ground permits, all numbers should lie down, Nos. 3 and 4 forming

a short chain of supply, and the remainder continuing the chain or representing reserves to replace casualties.

2. The purpose of sub-section and section drill is to accustom the various numbers to work as a fire unit, and to provide practical instruction in the following subjects :—

- i. The delivery and execution of fire orders. This opportunity should be taken of practising officers and N.C.Os. in fire control.
- ii. Immediate action.
- iii. The replacement of casualties and breakages.
- iv. The supply of ammunition, oil, and water.
- v. The various drill movements for carrying out in-direct fire.
- vi. Limber drill and pack-saddlery drill.
- vii. Night firing drill.

*Note.*—The following drills can be carried out by sub-sections as well as by sections. Sub-section commanders will be afforded opportunities of training their sub-sections in them before commencing section drill.

### 3. Sub-section and section drill.

In order that a section may work in the field with efficiency, the methods of fire must be learnt as a drill. This will enable the personnel in action to reproduce automatically the movements learnt in practice, with such modifications as the conditions of battle may impose.

#### 4. Direct fire.

#### Kit required for each gun detachment.

Gun with the barrel casing filled, tripod, two belt boxes

and belts with dummies, spare parts case, condenser tube fitted to gun and condenser. Oil can and spare parts box complete required for each sub-section.

Direct fire drill will be taught in three stages.

i. *First stage.*

The detachments will be exercised in all the movements of elementary gun drill up to and including "Action" and "Cease firing," in both the normal and lowest positions. Fire orders should be simple, and alterations in elevation, deflection and targets should be practised.

ii. *Second stage.*

In addition to the points mentioned in the first stage, the fire orders should include the use of traversing, searching, combined sights and distribution (Secs. 53-55).

iii. *Third stage.*

In this stage service targets in the open country will be used.

In addition to the points mentioned in the previous stages practice should be given in :—

Immediate action.

Replacing casualties and breakages.

Ammunition, oil, and water supply.

5. *Indirect fire.*

**Kit required for each gun detachment.**

Gun and tripod.

Bar foresight (*see* Sec. 71).

Belt boxes (4), belts and dummies.

Condenser and tube.

Clinometer (to be carried by gun-detachment commander, *see* Sec. 74 and Appendix VI (A)).

Spare parts case.

Two posts—the "zero post" and the "target post" (to be carried by No. 3). *See* Sec. 74, 4 and 5.

**Additional kit required for each section.**

1 Angle of sight instrument (*see* Sec. 73 and Appendix VI (B)).

1 Director stand (*see* Sec. 73, 2).

1 Field plotter (*see* Sec. 75).

1 Range-finder.

Guns and tripods will be laid out as in elementary gun drill.

Indirect fire drill will be taught in four stages.

i. *First stage.*

**Instrument instruction and drill.**

This drill will include laying off angles with traversing dial and bar foresight, putting elevation on the gun with the clinometer, putting out zero and target posts and relaying on the latter, guns laying on each other to enable angles to be determined. When guns lay on each other, the point of aim will be the filling plug of each gun.



ii. *Second stage.***Laying guns on parallel zero lines.**

The section must now be layed on parallel zero lines.

All methods of doing this should be practised.

The drill, *i.e.*, using the director, will be as follows :—

(a) "**For indirect fire—Mount gun.**"—The guns are mounted on the positions indicated. No. 3 of each gun brings up two belt boxes and the condenser. The gun-detachment commander fits the bar foresight on to the gun.

(b) "**All on director.**"—Each gun is layed on the director and No. 2 zeroises the direction dial. The section commander calculates the angles through which each gun must lay off in order that the guns may be layed on parallel zero lines, *e.g.*, assuming that No. 4 gun is the gun nearest the director and that the director is to the front of the guns.

"Zero lines—No. 4, Zero—No. 3, Right, Four degrees—No. 2, Right, Eight degrees—No. 1, Right, One two degrees."

Each gun-detachment commander acknowledges the order for his own gun. The guns are swung through the angles ordered. The gun-detachment commanders see that the bar foresights and direction dials are set at zero.

(c) "**Out zero posts**"—No. 3 will then drive in the zero post in such a position as will ensure that the post will not be struck by bullets should fire be opened on zero lines.

In this he will be directed by No. 1, who will adjust the tangent sight slide to bring the line of sight on to the post.

The zero post will not be moved when once the gun has been layed on its parallel zero line.

iii. *Third stage.*

If the director is not available or the director cannot be seen by all the guns, the following drill should be adopted :—

(a) "**For indirect fire—Mount gun.**" "**No. 1 directs.**"—All guns will be mounted so that they can see the directing gun. No. 1 gun will be given an aiming point by the officer or N.C.O. controlling the fire. After laying on that point the firer will set his dial to 180 degrees.

(b) "**All on No. 1.**"—On receipt of this order all guns will lay on No. 1 gun and zeroise their dials. The firer of No. 1 gun will lay on each of the other guns in turn, the nearest sub-section commander giving the deflection required to put each gun on its respective zero line, *e.g.*—

"Zero lines—No. 2, Left, Nine owe degrees—No. 3, Left, Nine three degrees—No. 4, Left, Nine seven degrees."

All guns will lay off the angles ordered, after which the directing gun will relay on its original line. All dials will then be reset to zero.

(c) "**Out zero posts.**"—On receipt of this order Nos. 3 will place out zero posts.

iv. *Fourth stage.*

As for second and third stages, but introducing the issue, passing and carrying out of fire orders for indirect fire. The guns are first layed on parallel zero lines as described. The gun-detachment commander kneels down with the clinometer on the left of No. 1.

(a) "**All right (or left) ..... degrees.**"—The angle of switch necessary to engage the first target is given. The gun-detachment commander acknowledges the order. No. 1, assisted by No. 2, lays off the given angle from zero on the direction dial.

(b) "**Out target posts.**"—No. 3 drives in the target post as directed by No. 1 in such a position as to ensure that the post is not struck by bullets when fire is opened.

*Note.*—When the zero lines coincide with the required lines of fire as would usually be the case in methods (a), (b), (c) and (d) described in Sec. 58, it will be seen that there is no angle of switch.

(c) "**Distribution—No. 4, nil — No. 3, right ..... degrees, &c.**"—The guns are layed off from the target post by means of the bar foresight.

*or*

"**Concentration — No. 4, nil — No. 3, left ..... degrees, &c.**"

(d) "**Elevation ..... degrees ..... minutes.**"—Each gun-detachment commander acknowledges

the order, and lays the gun to that elevation with the clinometer. No. 1 adjusts the tangent sight slide to bring the line of sight on to the target post and notes the reading on the sight.

*or*

"**Elevation—No. 4, three degrees—No. 3, three degrees two owe minutes—No. 2, three degrees four owe minutes—No. 1, four degrees.**"

Each gun detachment commander and No. 1 proceed as above.

*Note.*—These are alternative methods to deal with the necessity for one, or for more than one elevation.

(e) "**Load.**"—As in elementary gun drill.

(f) "**Check.**"—Each No. 1 checks his elevation and direction by means of the target post and gun-detachment commander checks clearance of obstruction (*see* Sec. 63) and target post.

(g) "**Traverse, &c.**"—Any special orders for traversing or allowance for wind will now be given.

(h) "**Fire.**"—Bursts of fire should not be less than 50 rounds. No. 1 relays between bursts. Accuracy in relaying must always be insisted upon.

6. Sections should be practised in coming into action in different positions, obtaining parallel zero lines by different methods, and firing by charts. In the latter case, verbal orders should be dispensed with as far as possible.

In the final stages of training, section commanders should be practised in applying the fire of their sections to any target with rapidity and accuracy. Throughout the drill, gun numbers must be changed round frequently.

#### 19. Night firing drill

1. *First stage.*—Instruction in aiming with night sights and aiming lamps (see Appendix XV).

*Note.*—All details of this process must be practised by day before being attempted in the dark, but it must be realised that it is only by constant practice in complete darkness that any degree of proficiency can be obtained.

i. Instructor describes night firing back and foresight and shows how they are to be attached to the gun.

ii. Instructor describes a correct original aim—Point A of foresight in centre of backsight aperture and in line with 6 o'clock on the bull's-eye.

iii. Instructor lays a correct original aim (eye close to aperture, fingers of left hand laid across the top of backsight shield), and makes students view the aim and then in turn lay the gun themselves.

iv. Instructor then demonstrates how to make alterations in direction and elevation by laying an original aim with Point A of the foresight, and then moving the gun until

various other points on the foresight shield are brought in line with the bull's-eye. (Fig. 16)

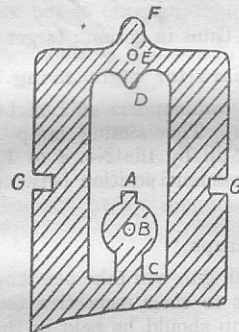


FIG. 16.

Point B gives 30' elevation.

Point C gives 1° elevation.

Point D gives 1° depression.

Point E gives 1° 30' depression.

Point F gives 2° depression.

Point G gives 1° traverse.

v. Men are then practised in making such alterations in elevation and direction.

vi. Paras. (iii), (iv) and (v) of the above sequence of instruction will now be carried out in the dark.

*Note.*—A dark shed which can be illuminated quickly is best, as students can then be shown their own faults in aiming by turning on the lights as soon as they have layed the gun.

2. *Second stage.*—Guns in action; target posts already out.

“Unload—Prepare for night firing.”

Gun-detachment commanders affix night sights and take clinometer reading. The aiming lamp box (1 per sub-section) is brought up by the No. 4 of 1 and 3 guns, who places it in a convenient position between the two guns of the sub-section.

“Out aiming lamps.”

The Nos. 3 of each gun will take one lamp out of the box, walk out and fix it to their respective target post. While moving out the lamp should be held in the right hand and the strain on the wire taken with the left. Nos. 4 will regulate the unwinding of the wires; and when the lamps are in position will turn on the lights, regulating their brightness as may be necessary. On completion Nos. 3 will report to the sub-section commander

“Load.”—As in elementary gun drill.

“Relay.”—The gun-detachment commander will check the elevation on the gun with the clinometer. No. 1 will check his aim on the aiming lamp.

“Stop.”

“Unload.”—As in elementary gun drill.

“In aiming lamps.”

The Nos. 3 will remove lamps from the target posts and walk slowly in towards the box. Nos. 4 will wind in the wires, taking care not to entangle them in so doing.

3. *Third stage.*—Guns in position in readiness; no target posts out. Gun positions indicated by pegs.

Nos. 3 will take out the aiming lamps attached to the target posts, reporting to the sub-section commander on completion. The section commander will direct the Nos. 3 where to place the lamps, by compass bearings from the gun position. The guns will then be brought up, mounted over the pegs, and layed on the lamps.

“In aiming lamps.”—As for second stage.

#### 20. *Sub-section and section training*

1. Before this training is commenced, a short lecture on reconnaissance should be given with special reference to the selection of sub-section and section positions. (*See Sec. 42.*)

2. The object of sub-section and section training is to exercise the unit in applying the lessons taught in drill to suit all forms of ground with reference to a tactical situation. All ranks will be exercised in their respective duties. All movements, dispositions, &c., will be made with reference to some tactical situation explained beforehand by the section commander. The situation must be such as will necessitate the employment of scouts and range-takers in a realistic manner. Ranges will actually be taken. Ammunition supply will be



carried out, empty boxes being passed back for refilling. The replacement of casualties and breakages will be practised, but must not be carried to an extreme.

As proficiency increases, practice should be given in situations which require rapid action, such as changes of targets and of gun positions to meet surprise situations.

The training should be carried out in stages or lessons as shown below, each of which is applicable to the sub-section and section.

### 3. First stage.

To give practice in the following :—

- i. Selection and occupation of gun areas and positions.
- ii. The use of cover in :—
  - (a) The approach to the gun position (*see* Sec. 41, 3).
  - (b) The gun position itself (*see* Sec. 41, 3).
- iii. Ability to fire within the arc of fire ordered.
- iv. The method of approach to the gun position as regards the carrying of the gun, tripod, &c. Concealment will be considered of greater importance than rapidity within reasonable limits.
- v. Effective control from the observing post.
- vi. Ammunition supply.

In this lesson limbers will not be used, but the sub-section or section should be drawn up in a position in readiness at least 300 yards from the ground on which the guns will come into action. The ground selected should be suitable for inculcating the lessons to be learnt in the reconnaissance and selection of gun positions (*see* Sec. 42) and in the use of ground (*see* Sec. 41).

The frontage should be at least 200 yards wide, and should contain more than one possible position.

### 4. Second stage.

As for first stage, but introducing action from limbers. This will entail attention to the following points :—

- i. After the gun position has been selected and the order has been given to bring up the guns, application of drill is required in getting the guns into action. The danger of the detachments bunching together when advancing from the limbers to the gun position must be avoided.
- ii. Broadly speaking, except in the case of a fleeting target, when it will be expedient to open fire at once with the first gun to get into action, a sub-section or section commander will wait until all his guns are ready to open fire before he gives the signal to do so. A systematic arrival of the various numbers at the gun position should be aimed at. Undue haste, which will only lead to confusion, should be avoided. Detachments must be well under control when going into action. There is need for quick action, but it must not be allowed to degenerate into a scurry, and there should be no shouting.
- iii. Generally speaking, crawling should be confined to movement over the last few yards in approaching a position. When longer distances must be covered, in possible view of the enemy, it is better to make a bold dash right up to the gun

position, simulating the movement of infantry as much as possible.

- iv. *Protection*.—The principle that every unit is responsible for its own protection must be impressed upon all ranks, and practice must be given in the methods of protection to be employed. The measures against surprise which have been taken when the guns are on the move must not be relaxed when the guns are in action. Protection of the flanks is of special importance, and steps must always be taken to watch any locality from which the gun position may be turned. Protection from the air must always be kept in mind.

#### 5. *Third stage.*

As for previous stages, but introducing changing from limbers to pack and coming into action from the latter.

*Note*.—The ground selected should, if possible, be such as to necessitate this change.

#### 6. *Fourth stage.*

As for the third stage, but introducing a forward movement of the sub-section or section, on limbers, to another position.

*Use of limbers*.—The fullest possible use should be made of limbers for the rapid conveyance of guns and men.

Where the line of approach is concealed from the enemy, limbers should be brought up as close as possible to the gun position and should remain as near the guns as is possible with safety.

In a situation where it is absolutely essential to get into action without a moment's delay, and

where the nature of the ground permits of no alternative, limbers should be driven boldly up to the gun position, quickly unloaded, and as quickly driven away to suitable cover.

Limbers must not bunch together. They should be kept at least 40 yards apart whenever they are on ground which may be subjected to fire. Touch must be kept between the limbers and the guns when the latter are in action.

#### 7. *Fifth stage.*

As for the previous stages, but with the forward movement carried out on pack (*see note to third stage*).

#### 8. *Sixth stage.*

As for fourth stage, but applied to suit indirect fire positions and introducing selection of gun positions by gun-detachment commanders to ensure clearance of the immediate obstruction in accordance with instructions received regarding lowest elevation to be used and limits of arc of fire.

9. After the section has attained proficiency in each of the above stages, it should be practised in carrying out elementary tactical exercises framed so as to bring out all the lessons to be learnt in several of the above stages, and carried out on different areas of ground.

It will be of great advantage if these exercises can be carried out in co-operation with other portions of the battalion. Before each exercise is begun the section commander will explain its purpose and the principles which will be followed in carrying it out, and, on its conclusion, detailed criticism will be made.

In this way the rank and file should gradually be trained in elementary tactical principles, and their initiative encouraged and developed along sound lines. In these exercises, in addition to all the points mentioned previously, particular attention should be paid to :—

- i. Formations to be adopted in battle (*see* Infantry Training, Vol. II, 1925). The nomenclature given in this manual should be modified to suit the requirements of a machine-gun platoon, viz. :—  
For company read machine-gun platoon; for platoon read machine-gun section; for section read machine-gun detachment.
- ii. Inter-communication, both by signal and orderly.

## CHAPTER IV

### LIMBER DRILL

#### 21. General instructions

I. In packing limbers, attention should be paid to the following considerations :—

- i. *Tactical*.—These will affect the distribution of the loads both as between each portion and as between the limbers themselves. In the system detailed below all equipment and supplies necessary for the guns being brought into action are carried in the fore portion of the limber and further supplies are carried in the rear portion.
- ii. *Balance of limbers*.—It is important, if galls on the animals are to be minimised, that the load in each portion of the limber should be well balanced. Also, the fore portion should carry a heavier load than the rear portion.
- iii. *Speed in coming into action*.—In order that the guns may come into and out of action as rapidly as possible it is necessary for all ranks to know exactly where every article is carried, and for the gun numbers to be well drilled in packing and unpacking the limbers. A uniform system should be adopted, and in every section a N.C.O. should be detailed to supervise the packing of the limbers correctly.

2. In this chapter a drill for packing the limbers is given. The drill will be carried out at the double. The tailboard of the fore portion should never be lowered when the rear portion is attached and the animals are hooked in.

The pack saddlery will be carried on the off-side animals, with the exception of the hangers and racks (carried in the rear portion of the limber) and the water boxes\* (carried in the fore portion of the limber).

3. *Packing limbers.*—The equipment, as shown in the load tables (limber) (see Field Service Manual), will be dumped in rear of the limber.

"**Fall in.**"—The sub-section (excluding drivers, who will stand to their horses) will fall in immediately in rear of the limber, in two ranks.

"**Number.**"—As in elementary gun drill.

4. "**Pack limber.**"

i. *Fore portion* (Plates X and XI).

On the command "Pack limber," the Nos. 1 and 2 double to the dump, take three belt boxes each and place six on each side of the limber, upright, the side of the box touching the side of the limber, arrowhead pointing inwards.

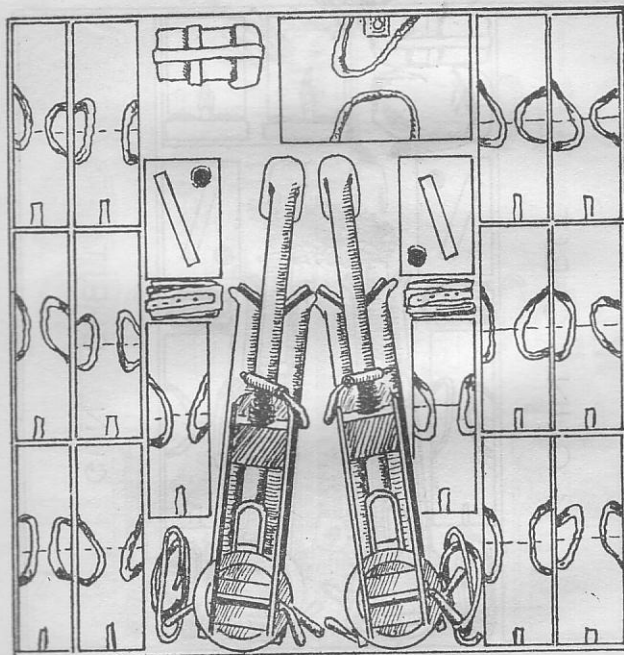
Immediately the belt boxes are in position the Nos. 3 and 4 place the gun chests on top, one on either side of the limber, hinges towards the sides of the limber.

The Nos. 1 will then follow with the tripods and condenser tubes, placing the tripods in the centre of the limber, cross-heads touching the tailboard and as close to each other as possible. The condenser tubes will be placed between the heads of the tripods and the belt boxes.

\* For units not equipped with water cans or condensers.

## PLATE X

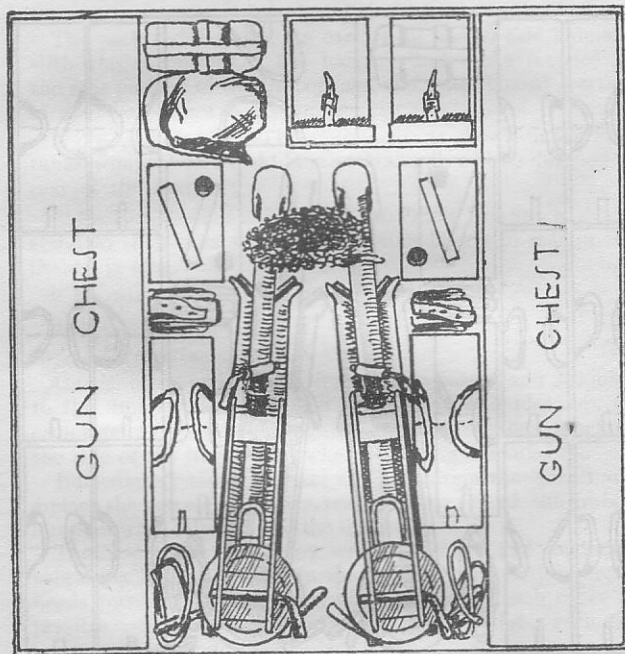
LIMBER—FORE PORTION—BOTTOM LAYER  
(Nos. 12 AND 14 WAGONS)



NOTE.—For difference in contents between Nos. 13 and 15 wagons see F.S. Manual.

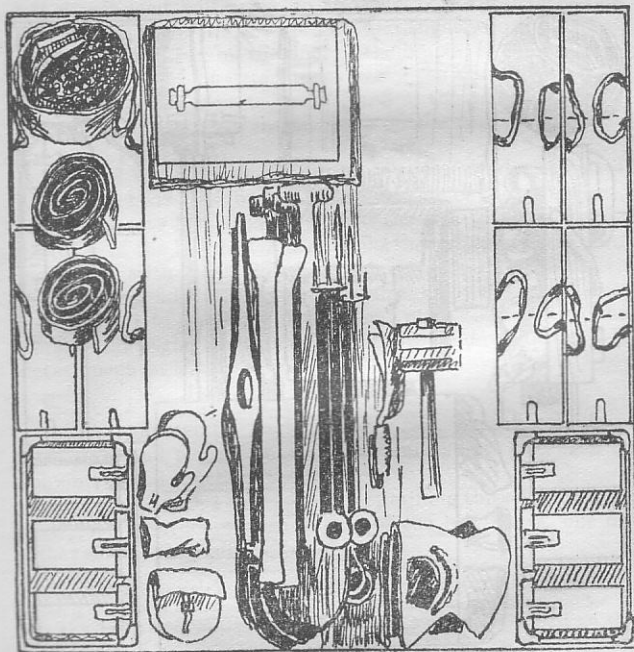


## PLATE XI

LIMBER—FORE PORTION—TOP LAYER  
(Nos. 12 AND 14 WAGONS)

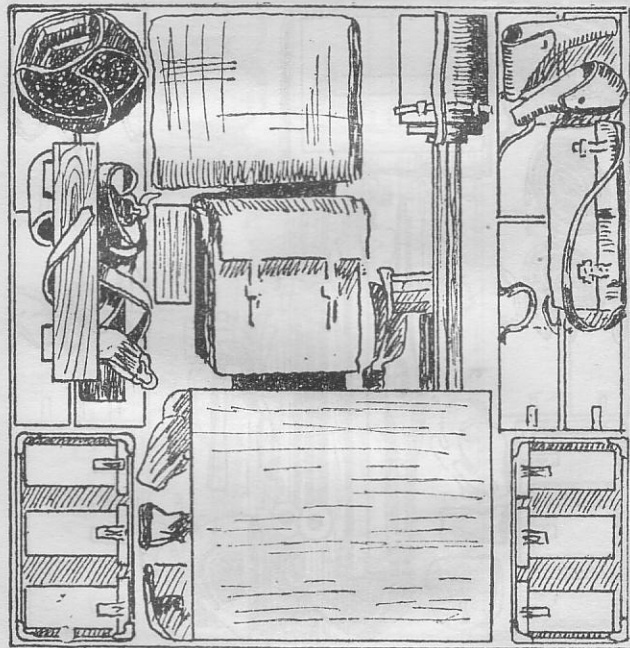
NOTE.—For difference in contents between Nos. 13 and 15 wagons see F.S. Manual.

## PLATE XII

LIMBER—REAR PORTION—BOTTOM LAYER  
(Nos. 12 AND 14 WAGONS)

NOTE.—For difference in contents between Nos. 13 and 15 wagons see F.S. Manual.

PLATE XIII  
 LIMBER—REAR PORTION—TOP LAYER  
 (Nos. 12 AND 14 WAGONS)



NOTE.—For difference in contents between Nos. 13 and 15 wagons see F.S. Manual.

No. 2 of the right detachment will bring up the spare parts box and place it in the front end of the limber, slightly to the off side, hinges to the rear. At the same time No. 2 of the left detachment will bring up two belt boxes and place one on each side of the limber, upright, and slightly to the rear of the middle belt box on the floor of the limber.

No. 3 of the right detachment packs the spare parts cases on top of the spare parts box. No. 3 of the left detachment packs the oil can cases in the space on the near side against the spare parts box.

No. 4 of the right detachment packs the condensers with fillers attached\* upright, one on either side of the tripod legs, each condenser being placed against the belt boxes.

No. 4 of the left detachment packs the two spare belts, two surcingles with pads and horse shoe valise (filled) so as to protect the condensers from being damaged by the tripod legs.

All Nos. 1 to 4 of each detachment place the cover on the limber, the right detachment on the off side and the left detachment on the near side.

ii. *Rear portion* (Plates XII and XIII).

On the command "Pack limber," Nos. 5 each take four belt boxes and place them in pairs, four against side each of the limber and touching the front.

Nos. 6 take each 1 canvas rack (containing three belt boxes), and place them lengthwise in rear of the belt boxes, one on either side of the limber.

\* In the Territorial Army, which is issued with a canvas condenser bag, instead of a water can, the following modification will be made:—

Condenser bags and tubes will be carried empty and packed on the legs of the tripods in the fore portion of the limber, and the water box packed upright against the rear of the spare parts box.

The gun-detachment commander of the right detachment takes the aiming lamps and the gun-detachment commander of the left detachment takes the saddle blankets, and together they pack them against the front of the limber, using the saddle blankets for protecting the lamps in transit.

No. 5, right detachment, then takes the target and zero posts, and No. 5, left detachment, the picks and shovels and place them in the centre of the limber, heads to the rear.

No. 6, right detachment, takes the bill-hooks and mallet and two web surcingles (for use with packsaddlery); he places the bill-hooks and mallet with the picks and shovels, and the two surcingles on the middle pair of belt boxes on the near side of the limber.

No. 6, left detachment, takes the two water buckets containing the harness brushes, hay nets, and spare belts and places them on the belt boxes in the near fore corner of the limber.

The gun-detachment commander of the left detachment takes the director stand and places it in the right centre of the limber, head to the front between the aiming lamps and the belt boxes.

The gun-detachment commander of the right detachment packs the two signal pistols on top of the belt boxes, on the right of the limber and close up to the front edge. He then places the field plotter on the belt boxes immediately in rear of the signal pistols.

Nos. 5 then pack the folding saw, old linen (for cleaning guns), the capes and gloves, machine gunners, in the centre of the limber.

Nos. 6 pack the tripod and gun hangers, and the gun-detachment commanders pack the drawing board and drawing

instrument in any convenient position so that they will not be damaged in transit.

Nos. 5 and 6 then replace the limber cover; right detachment working on the off side, left detachment on the near side.

## 22. Action from limbers

### 1. "Prepare for Action."

On the command "Prepare for Action," Nos. 1 to 4 of each detachment double to the limber (the right detachment on the off side, the left detachment on the near side) and remove the covers from the limber.

The Nos. 1 take the tripods and carry out their normal duties.

The Nos. 2 and 3 remove the guns from the chests.

The Nos. 3 take out the spare parts cases, and hang them over the shoulders of their Nos. 2, who then fit on condenser tubes and double out with the guns to their Nos. 1.

The Nos. 3 each take two belt boxes and carry out their normal duties.

The Nos. 4 each take one belt box, the condenser filled with water, and carry them up to their Nos. 3. They then return to the limber for two more belt boxes, and with these boxes take up a position under cover from where they can see their Nos. 3.

The limber and spare numbers, if not already under cover, will move to the nearest available, taking care not to lose touch with the numbers serving the guns.

### 2. "Cease firing."

On the command "Cease firing" the N.C.O. moves the limber up to the most convenient position for the guns

coming out of action, consistent with the safety of the animals.

The Nos. 3 and 4 take out the gun chests, repack the belt boxes, and tidy the limber.

The Nos. 4 take the condenser tubes off the guns as soon as the Nos. 2 arrive with them.

The Nos. 2 and 3 repack the guns in the chests, close the lids, replace the chests, and the Nos. 2 hand the spare parts cases to the Nos. 3 to repack in the limber.

The Nos. 1 repack the tripods and condenser tubes, the Nos 4 repacking the condensers.

All numbers 1 to 4 of each detachment replace the cover on the limber, the right detachment on the off side and the left detachment on the near side.

## CHAPTER V

### PACK SADDLERY DRILL

#### 23. General instructions

1. Pack saddlery is used as a method of carriage by :—

- i. Machine-gun squadrons (cavalry).
- ii. Machine-gun platoons (infantry), whether their equipment is carried (a) entirely on pack, or (b) normally in limbers.

2. When it is found necessary to use pack animals instead of limbers, the two lead animals of the limbers will become pack animals, the near leader carrying the ammunition pack and the off leader the gun and tripod pack.

Each gun detachment should be practised in the following drill, for which purpose the detachment will consist of Nos. 1 to 6, No. 6 acting as leader of one pack animal.

To prevent alarming the animals the drill will be carried out in quick time, not at the double.

*Note.*—For details of sets and description of gear, see Chapter XV, Handbook for the .303-in. Vickers Machine Gun, 1923. The nomenclature of the hanger with two narrow slings, used in this drill for the gun, is the hanger, gun, sling; and the hanger, with one wide and one narrow sling, used for the tripod, the hanger, tripod, sling.



24. *Loading pack saddles from limbers*

## 1. "Fall in."

On the command "Fall in," the sub-section (excluding drivers, who will remain mounted) will fall in immediately in rear of the limber, in two ranks.

## 2. "Number."—As in elementary gun drill.

## 3. "On Pack Saddles."

On the command "On pack saddles," No. 5 moves up and holds the lead horses, and No. 6 after applying the brake moves up and holds the wheel horses. The lead driver releases the straps and breast collar quick releases on the near side of each lead horse. The lead horses are then walked forward clear of their harness by No. 5. The lead driver dismounts and off-saddles the near lead horse.

The wheel driver dismounts, takes off the pack saddle and two feeds from the off-wheel horse and puts the feeds in the rear portion of the limber; with the assistance of the lead driver, he puts the pack saddle on the near lead horse and adjusts the packsaddlery breast collar and breeching of the off lead horse. Both drivers then place all surplus harness in the fore portion of the limber. The lead driver then holds both lead horses while they are being loaded and the wheel driver holds the wheel horses.

At the same time Nos. 1, 2, 3 and 4 take off the cover of the front portion, and the cover of the rear portion of the limber, and the gun detachment, employed as below, remove the necessary gear and equipment required for the packs, so that the drivers can place their harness in the limbers.

i. *Gun and tripod pack* (Plates XIV and XV). Numbers required—1, 2, 3 and 4.

PLATE XIV  
PACK SADDLE—GUN AND TRIPOD PACK—NEAR SIDE

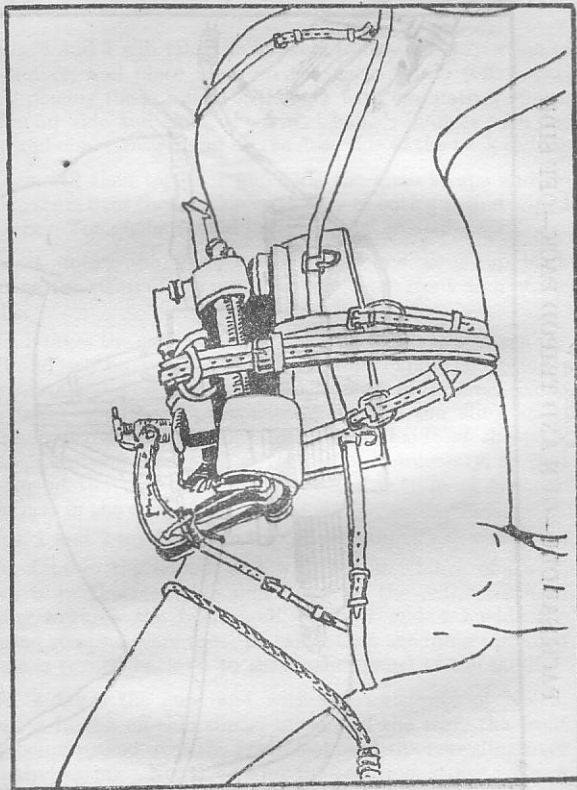
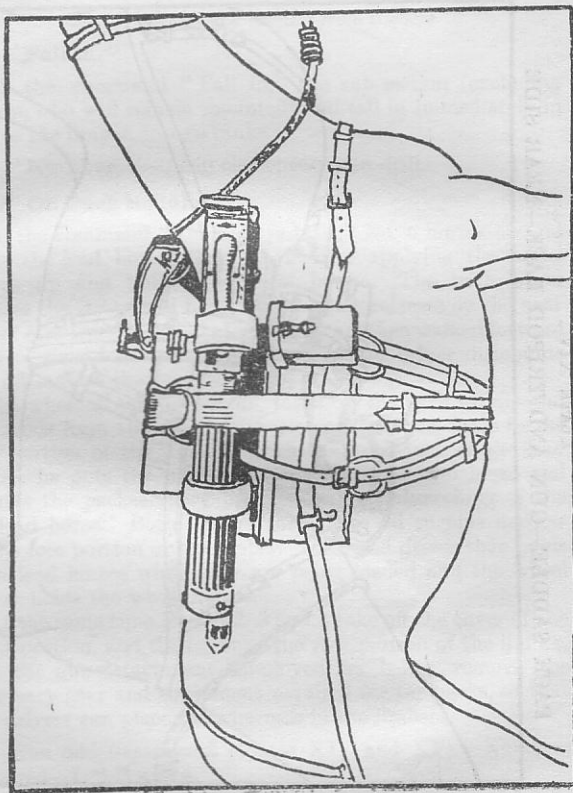


PLATE XV  
PACK SADDLE—GUN AND TRIPOD PACK—OFF SIDE



Nos. 3 and 4 will take the hangers from the rear portion of the limber, and place them on the pack saddle (off leader) No. 3 placing the gun hanger (hanger with two narrow slings) on the off side and No. 4 the tripod hanger (hanger with one wide and one narrow sling) on the near side of the pack saddle.

They will then together unbuckle the girth straps and re-buckle them over the wooden cross bars of both gun and tripod hangers. The girths should invariably be crossed.

No. 4 unties the feeds and replaces one as a top load, securing the strap of the nose-bag round the front arch of the saddle.

No. 3 takes the canvas water bucket and puts it between the front and rear arch of the saddle, the rope handle going under the rear arch and on to the rear off-side hook of the tree. No. 3 also takes the spare parts case and hangs the sling strap of the case over the two hooks on the off-side of the pack saddle, adjusting the length of the strap, if necessary, so that the top of the case will just touch the bottom of the gun when it is in the slings.

Nos. 1 and 2 take out one tripod and gun.

No. 1 takes the tripod, and with the assistance of No. 4, places it in the near side slings, legs to the rear, crosshead leaning towards the front arch. Nos. 1 and 4 buckle the securing straps. Care must be taken that the inner jamming handle is turned back on to the leather panel of the saddle.

No. 2 takes the gun, and with the assistance of No. 3, places it in the off-side slings, muzzle to the rear, the front sling being passed over the feed block and the rear sling over the barrel casing. No. 2 buckles the securing straps. No. 3

takes the cleaning rod and pushes it through the gun slings, front to rear, where the metal rings are held by the leather slings.

Nos. 3 and 4 each take one belt box and place them respectively between the gun and arches of the saddle, and the tripod legs and arches of the saddle, lids facing outwards.

The Nos. 1 and 2 fix the straps, long and short, which are on the bars of the hangers, round the tripod legs and gun respectively, and buckle them on to the steadying strap. Nos. 3 and 4 pass the web surcingle through the belt box handles and secure under belly on the near side.

\*ii. *Ammunition pack* (Plate XVI). Numbers required—5, 6 and the gun-detachment commander.

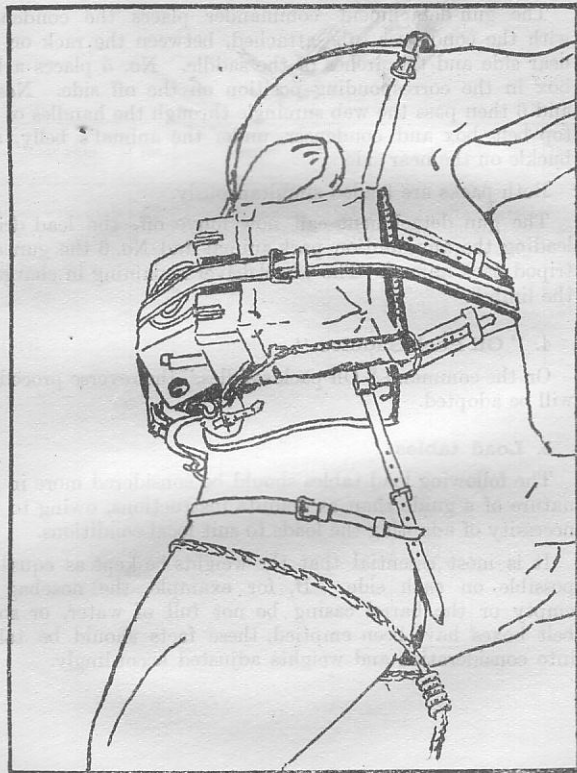
The gun-detachment commander fastens the other feed from the off-leader on to the rear side hook of saddle.

No. 5 takes a full ammunition rack containing three belt boxes and No. 6 takes an ammunition rack containing two belt boxes and the oil can case. Working together, No. 5 on the off side, No. 6 on the near side, they hang the racks on the pack saddle hooks, the metal "D" on the bottom of the rack being nearest to the animal, and the lids of the boxes being away from the animal.

They now fasten the steadying strap (leather girth), each end, when long enough, being passed through the slot in the "lay on" of the pack saddle, through the metal "D" on the rack and then buckled.

\* NOTE.—These instructions are for equipment at present in use and will require to be modified on the introduction of "stripless" belts packed in special boxes.

PLATE XVI  
PACK SADDLE—AMMUNITION PACK



The gun-detachment commander places the condenser, with the condenser tube attached, between the rack on the near side and the arches of the saddle. No. 5 places a belt box in the corresponding position on the off side. Nos. 5 and 6 then pass the web surcingle through the handles of the top belt box and condenser, under the animal's belly, and buckle on the near side.

Both packs are loaded simultaneously.

The gun detachment can now move off, the lead driver leading the ammunition pack animal and No. 6 the gun and tripod pack animal. The wheel driver remaining in charge of the limber.

#### 4. "Off Pack Saddles."

On the command "Off pack saddles," the reverse procedure will be adopted.

#### 5. Load tables.

The following load tables should be considered more in the nature of a guide than as definite instructions, owing to the necessity of adapting the loads to suit local conditions.

It is most essential that the weights be kept as equal as possible on each side. If, for example, the nosebag be empty or the barrel casing be not full of water, or some belt boxes have been emptied, these facts should be taken into consideration and weights adjusted accordingly.

GUN AND TRIPOD PACK

Near-side	lbs.	Centre	lbs.	Off-side	lbs.
Tripod, with dials	52	Bucket, canvas	1	Gun, with barrel casing filled ...	42
Hanger, tripod sling ...	9	Case, horseshoe (filled) ...	3	Hanger, gun, sling	8
Belt box ...	21	Nose bag (filled)	8	Spare parts case ...	8
				Cleaning rod ...	1
				Belt box ...	21
Total ...	82	Total ...	12	Total ...	80

Recapitulation of weights.

	lbs.
Near-side ... ..	82
Centre ... ..	12
Off-side ... ..	80
Pack-saddle ... ..	28
	202



## AMMUNITION PACK\*

Near-side	lbs.	Centre	lbs.	Off-side	lbs.
2 boxes, belt (single) ...	42	Bucket, canvas	1	4 boxes, belt (single) ...	84
Rack (canvas) ...	6			Rack (canvas) ...	6
Case, can, oil ...	8			Case, horse shoe (filled) ...	3
Nosebag (filled) ...	8				
*Condenser ...	25				
Condenser tube ...	1½				
Carrier ...	3				
Total ...	93½	Total ...	1	Total ...	93

## Recapitulation of weights

	lbs.
Near-side ... ..	93½
Centre ... ..	1
Off-side ... ..	93
Pack-saddle ... ..	28
	215½

\* *Note.*—In the Territorial Army, which is issued with a canvas condenser bag instead of a water can, the following modification will be made:—3 belt boxes on each side will be carried, with the water box on the off side and the condenser bag and tube on the centre.

25. *Action from pack saddles*

## “Prepare for Action.”

On the command “Prepare for Action” the gun numbers will carry out their duties as for the command “Off pack saddles” and will prepare their guns for “Action.” They will only remove those articles which are actually required from the packs. The driver will hold both animals head to head.

The driver and No. 6 will assist each other to secure all loose gear and straps after the gun detachment moves off.

In the case of ammunition packs, care will be taken that the same number of belt boxes are removed from each rack, so that the remainder of the load is balanced.

26. *An alternative method of carrying guns and ammunition forward on pack animals*

1. The foregoing method only provides for one gun and its equipment to be carried forward from each sub-section.

Under circumstances which require all guns to be brought forward on pack animals the following method can be employed. This method is dependent upon the following extra articles of pack saddlery equipment for each sub-section being available, viz. :—

1 Gun hanger.	1 Bands, belly.
1 Tripod hanger.	1 “ “ strap, long.
2 Racks, ammunition.	1 “ “ “ short.
1 Girth leather.	2 “ “ supporting.

(36 inches by 1½ inches)

This alternative method provides for the two guns and tripods of the sub-section being carried on the pack saddles, the ammunition racks being secured together, and slung over the drivers' saddles. Special care must be taken to avoid galling the animals.

**"On Pack Saddles."**

2. On the command "On pack saddles" Nos. 1 to 4 of both detachments will remove the limber covers and take out the necessary equipment to load the gun-pack animals. These numbers will carry out the duties as detailed for Nos. 1, 2, 3 and 4 respectively in Sec. 24.

Nos. 5 of the left and right gun detachments move up and hold the off wheel and off lead horses respectively.

No. 6 (left detachment) applies the brake.

Both Nos. 6 then remove the four ammunition racks.

Drivers without dismounting unfasten the inside neck straps and breast collar quick release straps.

The lead driver walks his horses clear of the harness, dismounts and adjusts the breast collar and breeching of the pack saddle on the off lead animal. Both lead horses are then led into positions for packing.

The wheel driver dismounts, and with the assistance of the No. 5 (left detachment) unfastens the quick release straps on the bar supporting pole and lowers the draught pole. The wheel horses are led clear of their harness and the pack saddlery breast collar and breeching of the off wheel horse adjusted.

Both animals are now led into position for packing.

Stirrup irons will be crossed over the rear arch of the drivers' saddles.

3. The off side animals will now be packed, Nos. 1 to 4 of each detachment carrying out the duties detailed for Nos. 1, 2, 3 and 4 in Sec. 24.

Each gun-detachment commander, assisted by the Nos. 6, will connect two ammunition racks by means of rings or ropes and hang them over the drivers' saddles and secure them through the hole in the front arch of the saddle. The racks are made fast by a leather girth being passed under the animal's belly.

4. When packing is completed the Nos. 4 will carry the condensers with condenser tubes attached, Nos. 1, 2, 3 and 5 carrying extra belt boxes or other equipment as required. Nos. 6 remain in charge of the limber.

**27. Machine-gun platoons whose equipment is carried entirely on pack**

Where the ground renders it necessary or advisable (e.g., India), the equipment of a machine-gun platoon may be carried entirely on pack. In this case the sets of pack saddlery differ in certain details from those described above, and the method of loading, &c., is varied.

**28. Machine-gun squadrons**

1. Cavalry machine guns are carried on pack saddles and each N.C.O. and man of the gun detachment is mounted. As speed in coming into and going out of action is of utmost importance the personnel must be thoroughly trained in the loading and unloading of pack saddles. Men should first be practised in taking the gun and tripod off and putting them on the pack dismounted, and when efficient at this,

will undergo training in coming into action (see Sec. 201, Cavalry Training, Vol. I, 1924).

It is essential that every man should know how to strip the hangers and replace any damaged parts.

The drill contained in the following paragraphs will be carried out dismounted, after elementary gun drill, later in conjunction with gun detachment training, and finally during mounted training.

2. *Loading packs from ground* (see Plates XVII to XXIII).

i. *General instructions.*—Pack leaders (Nos. 8 and 9) will have saddled up pack horses with pack saddle, breast collar, breeching, crupper, nosebags, and shoecase in the normal way. No. 8 will also attach to the gun pack :—

*Near-side*—the gun hanger.

*Centre*—spare barrel.

*Off side*—one tripod hanger, one ammunition box and sling.

He will ensure that the girths pass through the ammunition box sling, and that the latter is put on after the tripod hanger. This will prevent the tripod hanger slacking off when the led horses are being taken back.

Nos. 1 and 2 will lay out gun, condenser, condenser tube and tripod as for dismounted drill.

Nos. 3 and 4 will load the ammunition racks as laid down in load tables.

No. 3 will be responsible for the cases, can, oil.

When a second ammunition pack is available, the numbers detailed to load it will attach the pick and helve after saddling up.

ii. *"Load pack."*—On the Command "Load pack,"—No. 1 picks up the tripod with his right hand under the dial,

jamming handle between first and second fingers; his left hand should grasp the rear leg just above the shoe. He then doubles forward and places it in the tripod hanger on the off side of the pack, just resting on the ammunition box. Holding up the tripod with the right hand he secures the "D's." Care must be taken that the front suspending strap passes above the right buckle and underneath the left knuckle of the tripod socket, the base of the socket lying flat on the saddle. If this is not done the load will not "ride." Then, using both hands, he will tighten up the detachable strap of the tripod hanger in the triangular buckle.

No. 2 takes up the gun in the normal manner, doubles forward and places the gun on the gun rest. He then puts on the "D's," tilting up the gun at the same time by placing the left hand on the pivot of the crosshead and raising it upwards and outwards. Next he buckles up the "V" sling attachment, taking care that neither the triangular buckle or the straps catch in either the feed block or vulcanite filling plug.

When straps are secure he will cant up the barrel of the gun with the right hand and depress the breech casing with the left hand to make sure that no part of the gun touches the animal's quarters.

No. 3 first takes up and puts on the cases, can, oil, passing the securing strap through and behind the arches of the pack saddle; then doubles back and fetches up the off side ammunition rack and load.

He attaches this to the pack by slipping the rings on the back of the rack on to the hooks of the pack saddle. When No. 4 is ready, No. 3 tightens up the steadying strap, making sure that it is passed through the runners of the girth.

No. 4 puts on the condenser in its leather carrier, with the condenser tube rolled and strapped on the upper side, between the rack on the near side and the arches of the saddle, then doubles forward with the near side ammunition rack and load. He places it in the manner described above on the hooks of the pack saddle, and passes the steadying strap through the runners of the girth and hands it up to No. 3.

On completion of the above duties the numbers double back and fall in in their original positions.

Where a second ammunition pack is available, it is loaded in a similar manner to the above, disregarding the cases, can, oil.

### 3. *Action from pack (dismounted).*

Teams will "fall in" in rear of packs as in elementary gun drill, ammunition pack to be in rear of gun pack.

#### i. "Action."

On the command (or signal) "Action," No. 1 doubles to the tripod (off-side), releases the detachable strap of the tripod hanger (quick release strap), grips the tripod at the socket with the right hand, while with the left he unhooks first the rear and then front running "D's" on the suspending straps from the hooks on the arch of the pack saddle, dropping the whole of the "V" sling attachment clear of the tripod, removes tripod, doubles forward (carrying it in the most convenient manner) and erects it on the spot indicated (about 20 yards in front) as in elementary gun drill.

No. 2 doubles to the gun, releases the gun rest strap (quick release), allowing the gun to sink into the gun rest, grips the right traversing handle with the left hand, while with the right he unhooks the "D's," unhooking the rear one first (it is frequently necessary to raise the gun slightly with

the left hand when unhooking the front "D") and dropping the slings clear. Retaining the grip of the right traversing handle he will seize the barrel casing just in front of cross-head, lift the gun clear of the gun rest and remove it from the pack, turns to his right and places the gun under the right arm and doubles forward, mounting it as laid down in elementary gun drill.

He will also take into action the condenser tube; he will be responsible for attaching it to the gun and to the condenser, which will be passed up to him by No. 4 through No. 3.

No. 3 doubles to the off side of the first ammunition horse, releases the quick release and removes the two outside belt boxes, doubles forward to a suitable position, ready to supply the gun immediately it is mounted. He will act as the channel of supply for water, breakages and repairs.

No. 4 removes the two belt boxes from the near side and takes up a suitable position in readiness to form an ammunition chain between the gun and pack horses. During subsection and section training, he should frequently be practised in removing all the ammunition from the pack and forming a small dump. He will pass the water up to No. 2 through No. 3.

No. 6 and 7 can also be exercised in their respective duties.

#### ii. "Cease firing."

On the command (or signal) "Cease firing" the whole of the detachment will act as in elementary gun drill, the led horses will be brought up as close as is compatible with safety, No. 1 will then place the tripod on the pack,



holding it with the right hand (as when removing from pack), while with the left he throws the sling up over the tripod and secures it, fastening on the rear "D" first. He will then tighten up the detachable strap (quick release), ensuring that the tripod is secure on the pack.

No 2 replaces the gun in the gun rest, retaining his hold on the right traversing handle; with the right hand throws the "V" sling attachment into position, securing the "D's" (rear one first). He then tightens up the gun rest strap, ensuring that the gun is properly secured.

No. 3 and 4 will replace their belt boxes ensuring that the load is evenly balanced and secure. No. 4 will replace the condenser.

The whole will fall in in rear on completion, as in elementary gun drill. (When working mounted, the whole will act as laid down in Sec. 201, 3, Cavalry Training, Vol. I, 1924).

## LOAD TABLES

## CAVALRY

Near-side	lbs.	Top load	lbs.	Off-side	lbs.
GUN HORSE					
Gun (with barrel casing filled, and tripod crosshead attached) ...	58	Shoe-case (filled) Spare barrel and cleaning rod in case ...	3½	Tripod (less cross-head) ...	36
Hanger, gun, sling, cavalry ...	7		5½	Box (with ammunition) ...	21
Nose bag (with feed) ...	8			Hanger, tripod, sling, cavalry	4½
				Nose bag (with feed) ...	8
				Sling, boxes, ammunition in belt, cavalry ...	2½
Total ...	73	Total ...	9	Total ...	72

## Recapitulation of Weights.

	lbs.
Load, off-side ...	72
Load near-side ...	73
Top load ...	9
Pack saddle ...	40
Grand total ...	194

LOAD TABLES—*continued*

Near side	lbs.	Top load	lbs.	Off-side	lbs.
1st AMMUNITION HORSE					
2 boxes, ammunition in belt (filled)	42	Shoe-case (filled)	3½	3 boxes, ammunition in belt (filled) ...	63
Condenser in carrier (filled) ...	28			Rack, boxes, ammunition in belt, Mark III	12
Shovel (in cap) ...	5			Shovel (in cap) ...	5
Nose bag (with feed) ...	8			Nose bag (with feed) ...	8
Rack, boxes, ammunition in belt, Mark III	12			Case, can, oil ...	8
Total ...	95	Total ...	3½	Total ...	96

*Recapitulation of Weights.*

Load, off-side ...	...	...	...	lbs.
Load, near-side ...	...	...	...	96
Top load ...	...	...	...	95
Pack saddle ...	...	...	...	3½
				40
Grand total ...	...	...	...	234½

LOAD TABLES—*continued*

Near side	lbs.	Top load	lbs.	Off side	lbs.
2ND AMMUNITION HORSE					
3 boxes, ammunition in belt (filled)	63	Shoe-case (filled)	3½	3 boxes, ammunition in belt (filled) ...	63
Rack, boxes, ammunition in belt, Mark III	12	Pick and helve	8	Rack, boxes, ammunition in belt, Mark III	12
Nose bag (filled) ...	8			Nose bag (filled)	8
Total ...	83	Total ...	11½	Total ...	83

*Recapitulation of Weights.*

Load, off side ...	...	...	...	lbs.
Load, near side ...	...	...	...	83
Top load ...	...	...	...	83
Pack saddle ...	...	...	...	11½
				40
Grand total ...	...	...	...	217½

PLATE XVII  
CAVALRY—GUN PACK HORSE

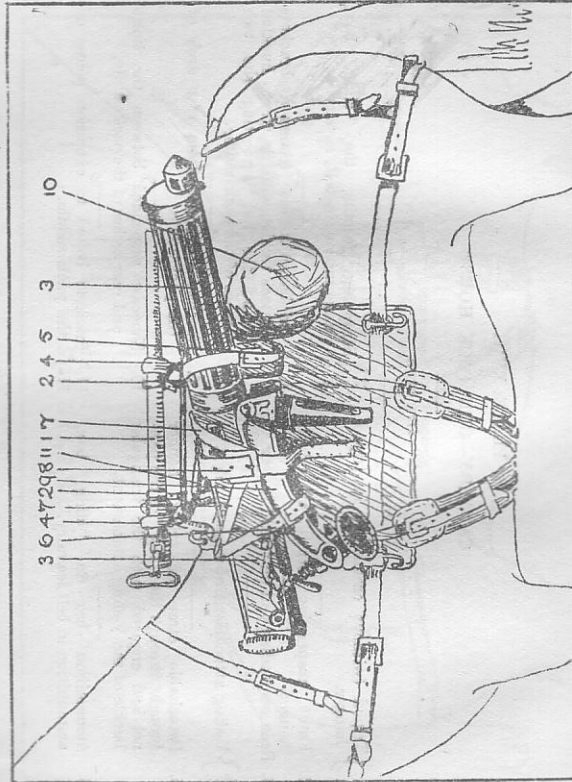
NEAR SIDE

1. Spare barrel in case, resting in bracket of pack saddle.
2. } Straps of spare barrel case buckled to the rod connecting the two arches of the pack saddle.
3. } Gun in the gun hanger.
4. } Brackets bolted to extension pieces of the pack saddle.
5. Rear suspending pad of gun hanger.
6. Front suspending pad of gun hanger.
7. } V-sling of gun hanger.
8. Gun rest strap brought through the "lay" of the pannal and engaged with the triangular buckle of the V-sling attachment.
9. Crosshead of tripod attached to the gun.
10. Nosebag suspended from rear arch of the pack saddle.
11. Shoease, suspended between the front and rear arches of the pack saddle.

[Chapter V. Section 28]

Chapter V. Section 28.]

PLATE XVII



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PLATE XVIII  
CAVALRY—GUN PACK HORSE

OFF SIDE

1. } Tripod (without crosshead) in tripod  
1. } hanger.
2. Front suspending strap of tripod  
hanger.
3. Rear suspending rod on tripod hanger.
4. } V-sling attachment of tripod hanger.
5. Detachable strap of tripod hanger  
brought through the "lay" of the panel  
and engaged with the triangular  
buckle of the V-sling attachment.
6. Ammunition box in "sling, box,  
ammunition in belt, cavalry."
7. } Strapping, forming the "sling, box,  
7. } ammunition, in belt, cavalry."
8. Spare barrel in case resting in brackets  
of pack saddle, with its straps buckled  
round the rod connecting the two  
arches of the pack saddle.
9. Noscbag suspended from rear arch of  
the packsaddle.
10. Shoe-case suspended between the front  
and rear arches of the pack saddle.
11. } Brackets bolted to extension pieces of  
11. } the pack saddle.

PLATE XVIII

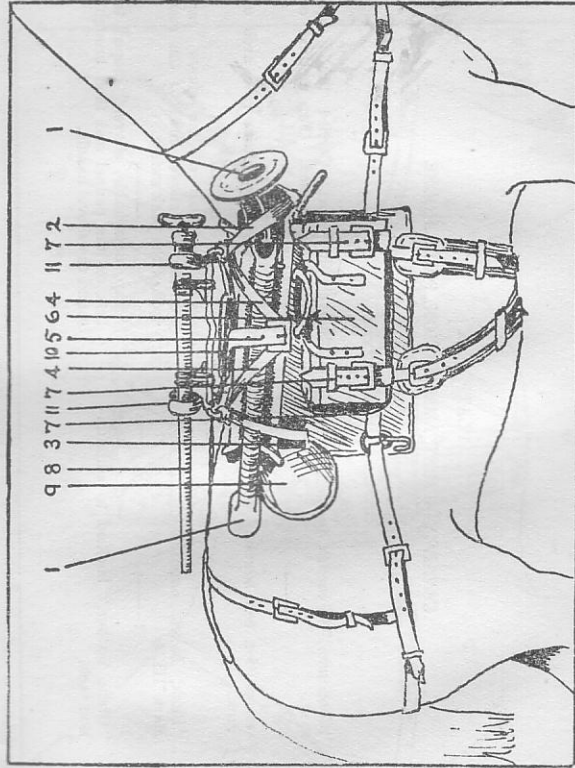




PLATE XIX  
CAVALRY—FIRST AMMUNITION PACK HORSE

NEAR SIDE

- |  |  |
|--|--|
| 1. "Condenser," in carrier on ammunition rack.   | 5. Shovels in caps. Carried heads upwards and crossed. (For method of crossing see Plate XXIII.)       |
| 2. } Ammunition belt boxes in ammunition rack.   | 6. Nosebag suspended from rear arch of packsaddle.   |
| 3. "Rack, boxes, ammunition, in belt, Mark III." | 7. Detachable strap of the shove cap securing the shovel head to the rear arch of the pack saddle.     |
| 4. "Girth, leather," buckled to ammunition rack. | 8. "Strap, detachable, shovel," looped to link on the pannel and then brought round the shovel handle. |

[Chapter V. Section 28.

Chapter V. Section 28.]

PLATE XIX

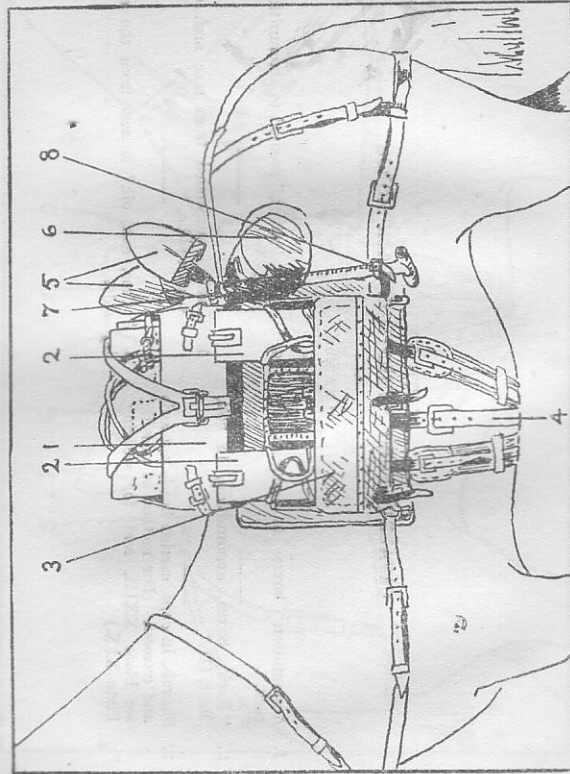


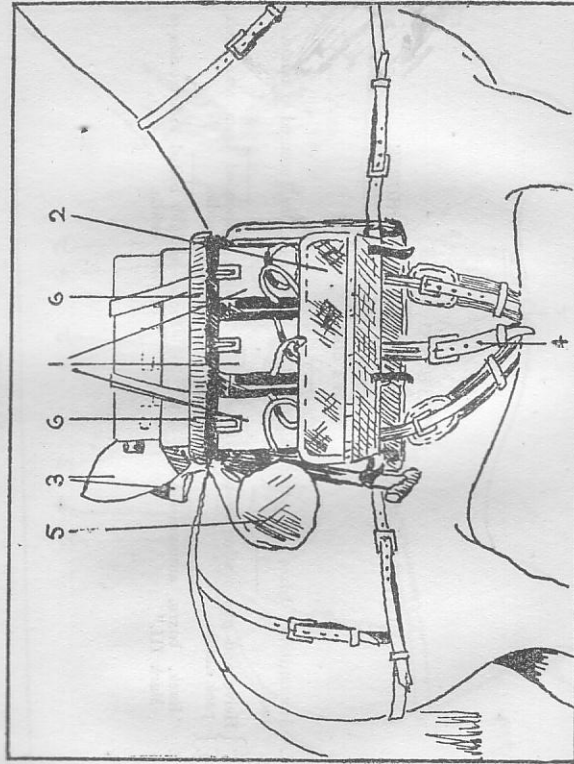
PLATE XX  
CAVALRY—FIRST AMMUNITION PACK HORSE

—  
OFF SIDE

1. Ammunition boxes in ammunition rack.
2. "Rack, boxes, ammunition, in belt, Mark III."
3. Shovels, in caps, carried upwards and crossed. (For method of crossing, see Plate XXIII, and for securing, Plate XIX.)
4. "Girth, leather," secured to ammunition rack.
5. Nosebag suspended from rear arch of pack saddle.
6. "Case, can, oil," as seen from the off side.

[Chapter V. Section 28.]

PLATE XX



Chapter V. Section 28.]



## PLATE XXII

## CAVALRY—SECOND AMMUNITION PACK HORSE

Showing method of attaching articles enumerated below

1. } "Axes, pick, helve" } Resting in  
1. } brackets of  
2. } "Axes, pick, head" } pack saddle.
3. } "Straps, detachable, pick and helve," }  
3. } securing the pickhead and helve to the  
3. } rod connecting the front and rear  
3. } arches of the pack saddle.
4. Rod connecting the front and rear arches  
of the pack saddle
5. Shoe case suspended from the front arch  
of pack saddle. (This method obtains  
also for the first ammunition horses.)
6. Nose bag suspended from rear arch of the  
pack saddle.
7. Front bracket bolted to extension piece  
of the saddle.
8. "Pack boxes, ammunition, in belt,  
Mark III," slung to the hooks of the  
pack saddle.
9. "Girth, leather," buckled to the ammuni-  
tion rack.

## PLATE XXII

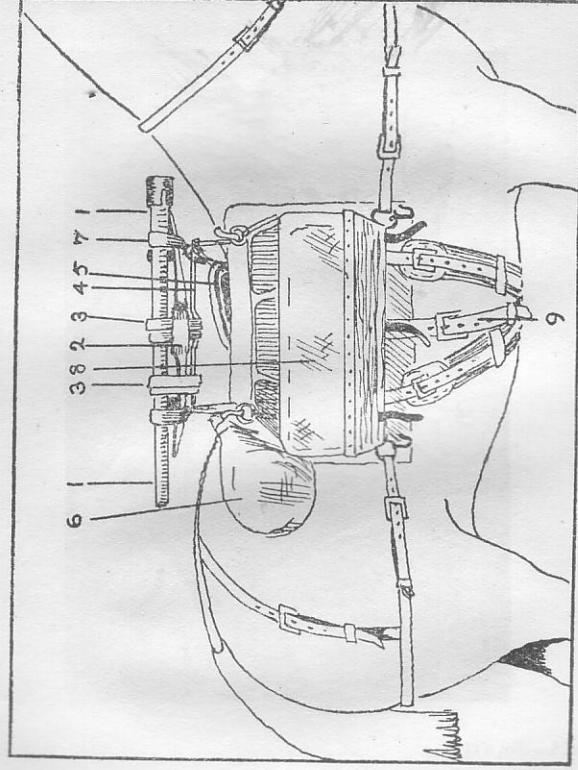
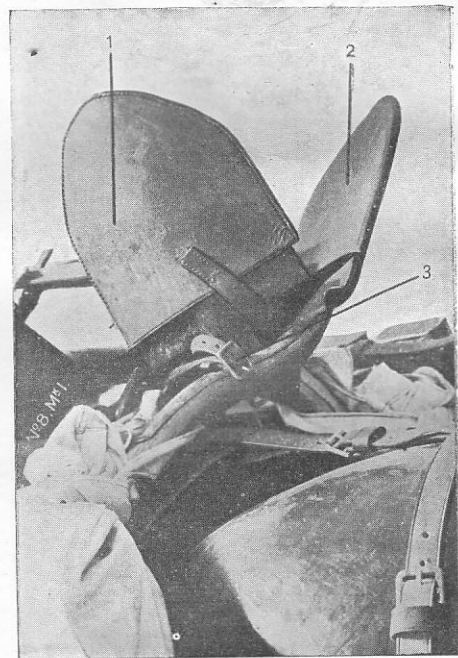




PLATE XXIII  
PACK SADDLE—CAVALRY

Showing method of crossing the shovels over the horse's back.

1. Shovel in the shovel cap, placed in position from the off side.
2. Shovel in the shovel cap, placed in position from the near side.
3. Detachable strap of the shovel cap brought round the handle of the shovel below the "pan" and then secured to the rear arch of the pack saddle. Both shovels are similarly secured.



## CHAPTER VI

RANGE-FINDING : OBSERVATION OF FIRE :  
RANGING29. *Range-finding, training and testing of range-takers*

*Range-finding is the process of determining the distance in yards to a given target.*

## 1. Methods of range-finding :—

- i. Instrument.—The mean error in range-finding by men specially trained in the range-finding instrument should not exceed 5 per cent. of the range for distances under 2,000 yards.
- ii. Maps.—This method is valuable when maps of large scale and known accuracy are available, and, if these are read correctly, the error should be negligible.

The error that may arise owing to the inaccuracy of a map should not exceed 5 per cent. of the range.

- iii. Judging distance.—Preliminary training will be carried out as laid down in Sec. 26, Small Arms Training, Vol. 1, 1924.

A special study will be made of the 500 yards and 800 yards ranges in order that the machine gunner may appreciate the distance at which to use the "fixed sight" on his gun and may distinguish the limit of close range (800 yards).

Officers and N.C.Os. will be taught to judge distance up to 1,500 yards inclusive. They will make a special study of the following ranges :—

- (a) 600 yards. Ability to estimate this distance will be of assistance to officers and N.C.Os. in the reconnaissance of a position in defence.
- (b) 800 yards and 1,500 yards. In order that a correct estimate may be made as regards the field of fire required (*see* Sec. 107, 1, i.).

At distances beyond 800 yards it is inadvisable to rely on judging distance as a means of ascertaining the distance unless observation of fire is possible and surprise effect is of secondary importance.

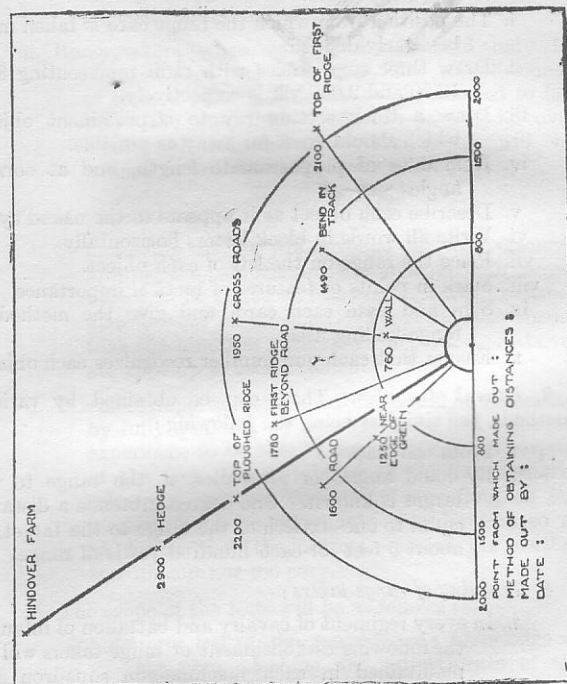
As, however, the determination of the number of guns necessary for fire effect depends to a large extent on the field of fire and range, officers are required to study those distances which are mainly affected by fire direction.

The inability of officers to appreciate distances on the ground in conjunction with the problem of fire direction can only result in the loss of fire power at the longer ranges.

- iv. Range cards.—In this method, objects are marked to which the ranges have been accurately obtained by either of the first two methods, and intermediate distances are estimated. (Plate XXIV.)

For these intermediate distances the error should not exceed 10 per cent. of the range.

PLATE XXIV.—RANGE CARD



## 2. Points to be observed in making a range card :—

- i. The position from which the range card is taken must be clearly defined.
- ii. Draw three semi-circles with radii representing 800, 1,600 and 2,000 yards respectively.
- iii. Draw a thick setting ray to a prominent object, which should be as far away as possible.
- iv. Rule lines of proportionate length, and at correct angles.
- v. Describe each object as it appears to the naked eye.
- vi. Write all words in block letters horizontally.
- vii. Place the range on the left of each object.
- viii. Mark in points or features of tactical importance.
- ix. Sign and date each card, and give the method of range-finding used.
- x. Ensure that each gun number recognizes each object.

3. *Lateral distances.*—These can be obtained by various methods, the simplest being the following :—

- i. From the map.
- ii. By hand angles or graticules, if the range to the target is known. One degree subtends a distance equal to one-sixtieth of the range to the target, or about 5 feet for each hundred yards of range.

4. *Training of range-takers :—*

- i. In every regiment of cavalry and battalion of infantry the following establishment of range-takers will be maintained in each machine-gun squadron and platoon, viz.: one officer and one serjeant as instructors, and four lance-corporals or privates as

range-takers. Only men of exceptional intelligence and activity and with good eyesight should be selected for training as range-takers.

- ii. Range-takers when once trained should only be changed for special reasons. The establishment of trained personnel should not be allowed to fall below the numbers laid down in para. 4, i above. Additional officers and other ranks will be trained in anticipation of vacancies.

5. *Test of range-takers :—*

- i. Commanding officers will arrange for the personnel forming the establishment of machine-gun range-takers to be tested at least once yearly to ensure maintenance of efficiency. They will also ensure that the numbers prescribed in para. 4, i above, are kept up to establishment.
- ii. It is most important that the tests should be conducted by fully qualified officers who have had sufficient experience to be able to recognize, for the purpose of the test, the suitability of the range marks selected; weather conditions prevailing at the moment must be taken into consideration so as to ensure that the objects selected are neither too difficult nor too easy.

## iii. The scope of the tests will be as follows :—

- (a) *An oral test* of the range-taker's knowledge of the care, cleaning and adjustments of the range-finder.



- (b) *A range-taking test*, with which will be combined the construction of a range card as described in para. 2 above.

iv. *Oral Test*.—The questions put to the range-taker should be such as will thoroughly test his knowledge of the methods of adjustments, care and cleaning of the range-finder. Optical questions will not be given.

The qualifying standard will be that which would be equivalent to 60 per cent. of marks if such were given.

When recording results, the range-taker will be shown as "Qualified" or "Failed."

v. *Range-taking test*.—The range-taking test will be carried out in two stages as under :—

*1st Stage*.—*A test of accuracy with rapidity in range-taking*.—

- (a) Six range marks will be selected at distances between 800 yards and 2,800 yards, distributed as under :—  
One between 800 and 1,000 yards.  
Three between 1,000 and 2,000 yards.  
Two between 2,000 and 2,800 yards.

(b) The range-finders to be used for the examination will be tested and adjusted for "zero" and "height of image" on the position selected for the test. The superintending officer will satisfy himself that the instruments are in good order and in adjustment before the test commences.

(c) The correct distance to each of the range marks will be ascertained by the superintending officer from the "mean" of a series of readings taken by

trained observers with the range-finders which are to be used in the test.

- (d) The distance to some point which will be suitable for use as a "zero test point" should be accurately determined. This point will then be used by each range-taker under examination to check the "zero" of his instrument.
- (e) Each range-taker under examination will first check the "zero" and "height of image" of the range-finder he is to use. He will make any adjustment that he may consider necessary.
- (f) The superintending officer will indicate by description, by means of a rifle laid from a rest, or by laying a machine gun, six practical service range marks the distance to each of which is required.
- (g) When the range marks have been identified and the range-taker is ready, the order "commence" will be given. The observer will then be allowed *six* minutes in which to take and record the distances to the range marks. Four readings should be taken on each point before deciding on the "mean" range to be recorded.
- (h) For all distances above 1,500 yards, the readings obtained will be recorded in multiples of 10 yards only.
- (i) On the expiration of the time limit, the range-taker will hand in his card with the recorded distances to the superintending officer.
- (j) *To qualify*, the average percentage of error for the six distances must not exceed 2.5, and the test must be completed within the time limit.

*2nd Stage.—Construction of a range card.*—This will be carried out immediately on completion of the 1st Stage as follows:—

- (k) A second card will be issued to the range-taker, on the back of which he will be allowed to copy for reference the distances obtained by him in the 1st Stage. The range-taker will then construct a range card of the area under observation, the six points already taken being recorded as the range points of the card.
- (l) The semi-circles will be drawn on the card before issue, but no further assistance is to be afforded the range-taker. He will select his own "setting ray" and complete his card as described in para. 2 above.
- (m) The time allowed for the construction of a range card will be 10 minutes.
- (n) *To qualify*, the range card must conform to the points described in para. 2 above; be neatly constructed, and of such accuracy that the points described can be identified by anyone not previously acquainted with them. The card must be completed within the time limit.

vi. The results of the test will be recorded on A.F. B 66A.

*Note.*—For test of range-finders, see Appendix X.

### 30. Observation of fire

1. Observation of fire means seeing the result of one or more bullets striking the ground or the enemy, and is a necessary preliminary to ranging. (See Sec. 31.)

2. Observation of fire is as important for indirect as for direct fire; it must be sought for whenever the target area can be observed and must be taught as part of the practical side of fire direction.

3. The nature of the ground and atmospheric conditions are the chief factors which determine the range up to which it may be possible to observe the fire of machine guns. An observer with field glasses will often be able to observe fire accurately up to 1,500 yards, but, except under very favourable conditions, little reliance can be placed on observation by the firer at ranges beyond 800 yards.

4. It is important that the following instruction shall be given in the early stages of training in observation of fire:—

i. Demonstration of machine-gun beaten zones on flat ground at short and medium ranges.

If facilities do not exist for carrying out these demonstrations with ball ammunition, the extremes (length and breadth) of the beaten zones should be marked by flags or fatigue men.

The effect on the beaten zones of firing from positions having command or against a forward slope (see Sec. 50) should be explained and, if possible, demonstrated with ball ammunition.

ii. Study of ground likely and unlikely to give observation of the bullet strike.

5. It must be impressed on all ranks that, to facilitate accurate observation, bursts of fire must be long enough to:—

i. Enable the area to be sufficiently covered with bullets to form a reliable beaten zone.

ii. To give the observer sufficient time to "find" a portion of the beaten zone and appreciate or "find" the remainder of the beaten zone.

Under favourable conditions, a burst of 15 to 20 rounds will often be sufficient to determine the nucleus of a beaten zone; when, however, the conditions for observation are unfavourable, it may be necessary to fire bursts of 40 to 50 rounds.

It must be remembered that it is necessary to "observe" the area in which the beaten zone is likely to fall rather than the ground in the immediate vicinity of a definite aiming mark. Efficiency in observation of fire can only be attained by means of actual practice with ball ammunition.

6. For the reasons given in para. 3 above, the training of the man in observation of fire should be limited to practice in observing fire at short ranges, i.e., up to 800 yards, for which purpose the ammunition allotted to practice 7, Annual Machine-gun Course is available. (See Sec. 35.)

7. In the case of officers, and N.C.Os. likely to become fire-unit commanders, training in observing fire at longer ranges is essential, and, in addition to the preliminary training outlined above, should comprise:—

i. *Instruction off the range:—*

- (a) Selection of observing posts to enable the best view to be obtained having due regard to concealment and communication.
- (b) Study of ground from the point of view of its effect on the length and possible visibility or otherwise of the beaten zone.
- (c) Use of field glasses and range-finding instrument to watch an area.

ii. *Instruction on a field firing range:—*

- (a) Demonstrations to show combined beaten zones at all ranges over 800 yards, with one or more elevations and with one or more points of aim.
- (b) Training the eye to pick up the bullet strikes with and without glasses.

The ammunition allotted to Part III, Annual Machine-gun Course (see Sec. 35) is available for the above purposes.

### 31. *Ranging*

1. Ranging is the process of determining by observation of fire the direction and elevation required to hit a given target.

The direction and elevation necessary to hit the target may differ from those required under normal conditions for any of the following reasons:—

- i. Atmospheric influences.
- ii. Peculiarities of the individual gun. These may be inherent or may be caused by wear, especially of the barrel (see Sec. 49, 5)
- iii. Variation in the ammunition.

Ranging should be employed whenever the tactical situation permits; by this means errors in direction and elevation are corrected and fire can be applied to the target.

2. Efficiency in ranging necessitates—(i) ability to observe fire correctly, and (ii) ability to make the necessary corrections as the result of observation.

Training in observation of fire has already been dealt with. The training of the man in the application, from the results

of observation, of the fire of a single gun to a given target, will be effected by careful instruction in ranging drill (Sec. 14) and the firing of the ranging practices in Part II, Annual Machine-gun Course.

3. In the practical application of ranging in the field, the responsibility for ordering corrections rests with the fire-unit commander.

In the case of officers, and N.C.Os. likely to become fire-unit commanders, in addition to ability to observe fire correctly, ranging necessitates a high standard of efficiency in fire orders and a thorough knowledge of fire direction.

4. Preliminary instruction, off the range, in ordering suitable corrections should be given to officers and N.C.Os. by assuming errors in direction and elevation and placing a flag or fatigue man to represent the centre or some portion of the beaten zone. The training of officers and N.C.Os. in this subject with ball ammunition should be carried out during the firing of Parts III and IV, Annual Machine-gun Course.

5. Surprise effect can only be obtained if the target is included in the beaten zone directly fire is opened or immediately afterwards.

When observation of fire is unobtainable, errors of direction and elevation must be estimated and allowed for by distributing fire laterally and by searching in depth. The methods by which this is effected are dealt with in Chapter IX.

## CHAPTER VII

### ANNUAL MACHINE-GUN COURSE

#### 32. General instructions

*Note.*—All references to figures in this chapter refer to Plate XXV (page 179 *et seq.*).

1. The Annual Machine-gun Course is divided into five parts:—

Part I.—Instructional.

Part II.—Observation, range and classification.

Part III.—Fire at long ranges, observation of the fire of a section, tests, demonstrations, indirect and night firing.

Part IV.—Tactical field firing. Schemes to be set by the commanding officer.

Part V.—Tactical field firing. Schemes to be set by the brigade or divisional commander.

2. The Annual Machine-gun Course will not be fired until the machine gunner has passed the tests of elementary gun drill (Sec. 15).

The machine gunner will not be considered a "trained" machine gunner until he has qualified in the classification practices, and taken part in field firing.

3. Every officer and every soldier in the machine-gun squadron or platoon will fire the full course of range practices



yearly. In addition every N.C.O. and man in the machine-gun squadron or platoon will take part in field firing. It is optional for officers of field rank to fire the course.

Every serving machine gunner who has left the machine-gun squadron or platoon will fire a refresher course yearly.

4. If a soldier has fired one or more rounds in any classification practice and is prevented from completing it, the points made will not count, and the whole practice will be re-commenced when his training is resumed.

5. In order that he may benefit by the ranging practices, practices 8, 9 and 10, and 11, 12 and 13 respectively, will be fired by the soldier consecutively before leaving the firing point.

If the soldier has fired a ranging practice and is prevented from firing an application or traversing practice which should be preceded by a ranging practice, the ranging practice will be repeated when his training is resumed.

If practice 14 is not fired by the soldier on the same day as practice 13, practice 11 will be repeated before firing practice 14.

6. The commanding officer will apply that a soldier detached from his unit may be exercised, at the station where he is serving, with a machine-gun unit of his own branch of the service.

7. Soldiers who have missed the whole or a portion of the range practices and have become available to commence the field practices with their squadron or platoon, may, if they have in their last qualification reached the "qualified" standard, be allowed by their commanding officers to execute the field practices, and fire the range practices subsequently.

8. Parts I and II will be fired in drill order, Parts III, IV, and V in marching order.

### 33. Range duties

1. During classification practices, which are tests of the results of training, officers, N.C.Os. and men from machine-gun squadrons or platoons other than that which is firing will be detailed under the orders of general officers commanding for all duties of supervising and marking, except in the territorial army, where the independent supervision need be carried out in the butts only, either by machine-gun officers, or, when this is impracticable, by officers of the same unit.

2. For the above practices, the provisions of paras. 10 and 11 below, will be scrupulously carried out.

3. One officer cannot supervise efficiently at the firing point more than four firers at one time.

4. If markers cannot be found from other units, officers of other machine-gun units, at least, should be specially detailed for supervision at the butts and the firing point.

5. One officer will be detailed to supervise at the butts the marking of not more than four targets.

6. Officers of the squadron or platoon which is firing will be detailed to assist superintending officers at the firing point as may be necessary. It will be their special duty to report to the officer superintending on any stoppages which may have occurred when all the rounds allotted for the practice have not been fired within the time limit allowed.

7. It is essential that all supervising officers at the firing point are trained machine-gun officers. If sufficient machine-

gun officers are not available for butt duty a proportion of other cavalry or infantry officers may be detailed for this duty.

8. For all practices, other than classification, there must be equally thorough supervision by officers at the firing point, but they may in this case belong to the machine-gun unit which is firing.

The duties specified in para. 11 below, will be carried out by N.C.Os. under such supervision as may be considered necessary.

9. To guard against accidents the following orders will be observed in addition to those given in Small Arms Training 1924 (Vol. I Sec. 77, 3, Vol. II., Sec. 11, 3, 4 and 6, Vol. III Sec. 16).

- i. No gun will be loaded until the senior officer present has ordered the practice to begin.
- ii. Before the red flag is raised at the firing point, signifying cessation of fire, the senior officer present will give the order "Clear guns," when the firer will remove the lock from the lock guides and report "Gun clear." The lock will remain in this position until the order "Load" is given.
- iii. The officers in charge of the left-hand section may give the signals to fire and cease fire for the whole line of guns under the orders—by signal or otherwise—of the senior officer conducting the firing; or in the discretion of the latter, each section officer may (subject to the flag which governs the whole firing point) be allowed to carry on independently for the section under his supervision.

10. The duties of the officer superintending at the firing point are:—

- i. In classification practices to vary the order of firing before the commencement of practices 8, 11 and 14. (Practices 8, 9, 10, and 11, 12, 13 respectively, will be fired consecutively without leaving the firing point.)
- ii. To see that each man on his roll (A.F. B 2050) fires at the target (or area in the case of ranging practices) to which he has been detailed, and fires with the machine gun and tripod which has been issued to his gun detachment. In classification practices the number of the gun and tripod used will be entered on A.F. B 2050.
- iii. During instructional practices—
  - (a) To allow no person at the firing point but the officers, the instructors, the men actually firing and their No. 2's.
  - (b) To ensure that the regulations as to target practice and local orders are obeyed.
  - (c) To detail a N.C.O. or man to send and receive messages on the telephone.
  - (d) To detail a N.C.O. to superintend each man's firing and to instruct.

iv. During classification practices—

- (a) To allow no N.C.O. or man within 20 yards of the gun positions, except the Nos. 1 and 2.
- (b) To see that the number of rounds allowed for the practice to be fired are not exceeded, and

that the belt is "spaced" as described in Sec. 34, 4.

- (c) Before each practice to allow each firer time to examine and attend to his gun, tripod and ammunition belt.
- (d) In timed practices to enter in the column of remarks on the roll (A.F. B 2050) the number of points to be deducted for any man firing after the signal "Stop" has been given (*see* Sec. 35, 9).
- (e) To see that no assistance of any kind is given to any number while he is at the firing point, with the exception of the No. 2 carrying out duties at the gun.
- (f) To decide whether extra time shall be allowed, or the practice fired again, in the event of a stoppage or stoppages in the gun (*see* Sec. 35, 9), and in the event of the officer on butt duty notifying him that more hits are on the target than rounds allotted for the practice, to fire the practice again (*see* para. 11, ix below).
- (g) To cause the targets to be checked immediately before every practice.
- (h) To see that the targets as erected on the butts give reasonable facilities for observing fire, either above, below or to one side of them.
- (i) To ensure after each practice, by personal inspection, that all rounds allotted for the previous practice and not fired have been removed from the belt and the number of

rounds fired are entered on the roll (A.F. B 2050).

- (j) To see that the tangent sight is not raised during the practices fired at 400 yards.
  - (k) Before traversing practices are commenced, to ensure that the firers understand the directions in which they are to traverse the gun at the commencement of the practice, and also that they have an opportunity of testing their clamp.
11. The duties of an officer on butt duty on a gallery range are as follows :—
- i. By actual measurement to ensure—
    - (a) That a blue pencil line has been marked correctly on the large (6 ft.) L.A. and M.G. targets; this line to be 6 inches from the edge of the target all round. (*See* Fig. 5, Plate XXV.)
    - (b) That the vertical lines on the L.A. and M.G. screens are marked correctly. (*See* Fig. 6, Plate XXV.)
    - (c) That the outside measurements of all targets are correct and that the targets are sufficiently clear to enable shot holes easily to be distinguished.
  - ii. To see that the butts and appliances are in good order, and to report damage and deficiency.
  - iii. To explain all regulations and local orders to the markers, and to ensure their observance.
  - iv. To detail markers to targets.
  - v. To see that the targets placed on the stop butts are so erected that they will give the best possible observation of fire to the firers.

- vi. To see that the area allotted to a gun for ranging practices is marked by an aiming mark, but that no target is erected for the purpose. (See also Sec. 35, 8.)
- vii. To check the application and traversing targets immediately before firing and to have patched out any hits which may have been made on them as the result of a previous practice.
- viii. To allow no one to touch the target until he is in front of it. Personally to check the target of each firer and to enter in ink the number of hits in the butt register (A.F. B 2050A). In traversing practices to enter on the butt register the number of "spaces" which contain no hits. No erasure is to be made in the registers. If alterations are necessary a fine line will be drawn through the figures, the correct figure written against it, and the amendment verified with the officer's initials.
- ix. If more direct hits are found on a target than rounds allotted, to cancel any score obtained, and at once inform the officer superintending at the firing point.
- x. To regulate the exposure of targets for practice 14 according to the instructions laid down.
- xi. To place a ring round each hit on the target with a coloured pencil before entering its value in the register, and to ensure that all shots are duly patched out.
- xii. On the conclusion of a practice to rule a line diagonally across the unused spaces in the register before signing it, and to hand all butt registers to the officer superintending at the firing point.

### 34. Special instructions

1. It is essential that the mounting and gun should be such as to enable the standard group (3-inch ring, containing 9 shots out of 10 at a range of 25 yards) to be obtained. This will be tested in the presence of the firers before Part I is fired, in the following manner:—

- i. Range, 25 yards. Target, any convenient vertical screen. Rounds 10 (one burst of fire).
- ii. The tripod will be erected on firm ground. Experience has shown that the firing of only 10 rounds will not be sufficient to affect the size of the group, provided the ground is firm or a T-base is used.
- iii. The gun will be half loaded and layed so that the shots will strike the screen. The traversing clamp will then be tightened. No aiming mark is required.
- iv. The trigger bar will be drawn back and retained in this position by inserting a No. 3 punch between the thumb-piece and the safety catch.
- v. The loading will now be completed and this will cause the gun to fire automatically until the 10 rounds are fired.
- vi. The group will then be measured. If the gun fails to group in a 3-inch ring the cause is generally attributable to the mounting. Steps must be taken to analyse the cause or causes of the failure to group, which must be eliminated before Part I is fired.

2. A similar test will be made at any time when it is suspected that the standard group is not being obtained.



3. Before Part II is fired the barrel will be tested for accuracy at 400 yards.

A target 6 foot square, provided with an aiming mark, will be suitable for the purpose.

A group of 10 rounds will be fired at this target, but previous to so doing a few shots will be fired into the stop butt to warm the barrel.

In order to ensure that the whole group of 10 shots will strike the target a few single sighting shots will be fired at the target and their position signalled from the butts. These single shots must be patched out before the 10 shot group is fired.

On conclusion the group will be measured and the area of the rectangle enclosing all the shots should not exceed 12 square feet. This area represents the average dispersion of a number of groups of which the figure of merit does not exceed the limit of 1.5 feet.

Should the area of the rectangle exceed 12 square feet the barrel will be tested for accuracy in accordance with the instructions given in Appendix XII.

*Note.*—The above tests will be of little value unless the gun and mounting are in perfect order.

4. In the preparation of machine-gun ammunition belts for classification practices each firer will load the rounds which he himself will fire. Each firer will be allotted a belt in serviceable condition for the firing of practices 8, 9, and 10. Similarly a belt will be allotted to him for practices 11, 12 and 13. Intervals of not less than 40 empty pockets will be made between the rounds allotted for each practice. When the firer has loaded his belt it will be packed into the belt box, which will then be marked with the firer's name. Before each

detail fires the No. 1 about to fire will bring up his belt box, take out the belt and lay it out for inspection by the officer in charge of the firing point.

The firer will at the same time have the opportunity of finally inspecting the belt.

For practice 14 a separate belt for each firer may be used, loaded with 50 rounds; or two groups of 50 rounds may be loaded in a belt, separated by 150 empty pockets, and in such a manner that the second firer can load his gun from the reverse end of the belt.

5. The officer superintending at the firing point is responsible that guns are unloaded before they are dismounted at the firing point.

### 35. *Method of conducting Parts I, II, III, IV and V*

#### Part I.

1. Part I is instructional and is carried out on the 30-yards range. In order to introduce the "first year" machine gunner to the firing of a machine gun, he will fire, during the early stages of elementary training, two groups of 10 rounds each on the 30-yards range at different aiming marks. This ammunition will be allotted from the C.O's. pool.

No time limit is placed upon any of the practices, and in order that the beginner may assimilate the lessons to be learnt all the practices of Part I should not be fired on one day. Each practice will be explained to each man before he fires. The best value will be obtained by criticising each practice while it is in progress, ceasing fire for the purpose, rather than by waiting until the practice is finished before commencing to criticise. At the conclusion of the practice faults should also

be pointed out at the target, and the firer told how to correct them.

2. The instructor at the firing point should watch the firer, *not* the target, in order that he may see that all points of elementary gun drill are carried out correctly. The shots on the target will bear witness to any faults that the firer may have committed whilst firing. Instructors must realise that the greatest care must be taken to eradicate such faults during the firing of Part I, so that the machine gunner shall not carry them with him and acquire faulty actions from the commencement of his training. This applies equally to the actions of the No. 2 at the gun. The following are the points to which particular attention must be made :—

In No. 1 :—

- Correct firing position and holding.
- Quick and accurate loading and laying.
- Correct pressure on the thumb-piece on the signal "Fire."
- Eyes on the target, not looking along the sights or down at the thumb-piece when firing.
- Attention to "Points during firing."

In No. 2 :—

- Inspection of ammunition and belts.
- Correct service position (lying).
- Attention given to control signals and to feeding the gun (not watching the target).
- Correct and rapid transmission of signals to "Fire" and "Stop."

3. If the point of mean impact of a group does not strike the target  $\frac{3}{4}$ -inch to the right of the point of aim, the foresight must be adjusted.

4. Practices of Part I may be repeated as considered necessary by the squadron or platoon commander, provided that the total number of rounds allotted to Part I is not exceeded. No record of results need be kept, but only the total number of rounds expended by the platoon in Part I.

#### Part II.

5. Before proceeding to fire practices 8 to 17, the machine gunner will be exercised in observation of fire on a field firing range (Practice 7). The practice will be limited to the observation of fire of one gun during this period of individual training (*see* Sec. 30). It is essential that the machine gunner should appreciate the varying conditions under which observation of fire may be possible, and for this purpose the range and the area selected for the beaten zone should be varied for the different numbers of the gun detachment. Further, as detachments will benefit from observing fire under varying conditions of weather and light, it is advisable to allot several days for the conduct of this practice, so that one detachment may receive further training when other detachments are being exercised.

6. In order that they may undergo instruction, at an easy range, in applying fire from results of observation, machine gunners who are in their first year of service in the machine-gun squadron or platoon will carry out the following instructional practices. These will be fired at a range of 300 yards and will be carried out after practice 7 and before the classification practices are commenced. The ammunition to be used for these practices will be taken from the amount allowed for practice 17. In order that the fullest value may be gained from these practices no time limit is imposed.

Nature of practice		Nature of target	Rounds	Remarks
Ranging	...	—	20	As for practice 8.
Application	...	Screen 6 ft. square	15	As for practice 9.
Traversing	...	Screen 3 ft. high, 20 ft. long	65	As for practice 10.

7. Practices 8 to 17, Part II, are fired on the classification range, and a strict time limit is imposed in the classification practices. In these the firer is classified as either a—

Marksman machine gunner,  
First class machine gunner,  
Qualified machine gunner,

according to the total score he obtains. The firer should have learnt by this time how to handle his gun, and consequently no help or criticism will be given while he is actually firing. He should be left to his own resources, with the object of developing self-reliance and confidence in himself and his weapon. The strictest possible discipline must be enforced at the firing point, and, as in Part I, all points of elementary training should be carried out correctly. In range work there is a tendency for these to be neglected, which can only be checked by the vigilance and care of section officers and instructors. Each practice and the time allowed will be explained clearly to each man before he fires.

8. Classification practices should be fired during the most favourable time of year for individual observation of fire, in order that the firer may obtain full advantage from the ranging practices. The results obtainable in the classification

practices will mainly depend on the observation obtained in the ranging practices (*see also* Sec. 32, 5).

When the weather conditions are such as to render observation of fire impossible to the firer, classification practices will not be fired.

On ranges where the nature of the stop-butt is such as to preclude observation of fire by the firer, steps must be taken under local arrangements to improve the nature of the stop-butt, in order that observation of fire may be obtainable.

In this connection the use of dry ashes, placed on portions of the stop-butt, has been found to give good results.

9. In classification practices (8, 9, 10, 12, 13 and 14) fire will be stopped as soon as the time limit is reached.

One-fifth of the total points scored in any practice will be deducted for each second the firer continues to fire after the signal to "Stop" has been given. No allowance will be made in these practices for stoppages which are due to causes other than defects of the mechanism, defective ammunition or breakages. The firer will be given time to look over the gun and ammunition belt before each practice is begun.

*Note.*—Should the stoppage be due to a defect in the mechanism, ammunition or to a breakage, sufficient time to remedy such stoppage will be allowed, or the practice may be repeated.

10. Points will be allotted as follows :—

PRACTICES 9 and 16 :—

For each hit on the target below and including

15 : ... .. 2 points.

For each hit on the target above 15 : ... 3 points.

## PRACTICE 10 :—

For each hit on the target :	1 point.
No spaces missed : add	30 points.
One space missed : add	25 points.
Two spaces missed : add	20 points, and so on.
Six or more missed : add	0.

## PRACTICE 12 :—

For each hit on the target below and including	
10 : ... ..	4 points.
For each hit on the target above 10 : ...	5 points.

## PRACTICES 13 and 17 :—

For each hit on the target :	1 point.
No spaces missed : add	50 points.
One space missed : add	45 points.
Two spaces missed : add	40 points, and so on.
Ten or more missed : add	0.

## PRACTICE 14 :—

For the first hit on the target : ... ..	30 points.
For each subsequent hit on the target : ...	5 points.

In practices 10, 13 and 17 the screens will be divided into rectangles by means of vertical lines, invisible to the firer, 20 inches apart (Fig. 6, Plate XXV). A space means any rectangle which does not contain a bullet mark. A hit on a dividing line to count as most favourable to the firer, but will only count in one rectangle.

In order to be classified as a—

Marksman machine gunner, 300 points must be obtained.

First class machine gunner, 250 points must be obtained.

Qualified machine gunner, 150 points must be obtained.

Those who obtain less than 150 points will be put back for further instruction.

## Part III.

11. The ammunition allotted to this part will be at the disposal of the squadron or platoon commander, and may be expended as he considers most beneficial for the efficiency of his squadron or platoon. This will, however, include :—

- i. Practice in observation of fire for officers, warrant officers and those N.C.Os. who may be called upon to control the fire of a fire unit (*see* Sec. 30, 7, ii).
- ii. Application of fire as the result of observation and when observation has not been obtained (*see* Sec. 31, 3).

Whenever possible, practice should be given in firing at ranges of 1,000 yards and over. No record of these rounds, other than the entry in the ammunition book, need be kept, nor should any statement of the method of expenditure be required.

12.—i. Observation and control of the fire of a section at ranges from 1,000 to 2,000 yards to include—

- (a) Observation of four beaten zones at separate aiming marks.
- (b) Selection of ground suitable for observation.
- (c) The use of combined sights.



- ii. Overhead fire, to teach and demonstrate possibilities and limitations of overhead fire.
- iii. Indirect fire by day by T.O.G. method, crest method and map shooting.
- iv. Indirect fire by night, to teach the necessary application of fire by night and at dawn.

As no tactical instruction is involved in Part III these practices should be fired by one section only, so as to get full value out of the ammunition, the N.C.Os. and men of the other section acting as spectators.

#### Part IV.

13. *Field practices* (rounds allotted 150).—The training of a machine-gun squadron or platoon cannot be considered complete until it has fired field practices on a field firing range.

The schemes for Part IV will be prepared by the commanding officer and should be schemes where the platoon or squadron is working with its own unit.

Part IV should include at least two days' field firing, *e.g.* advance and retirement, or attack and defence; the tactical handling of machine guns must be the predominating factor in framing these schemes.

As the amount of ammunition allowed works out at rather less than four belts a gun in Part IV, a limit must be placed on the amount fired in each situation.

#### Part V.

14. The scheme for Part V will be prepared by the brigade commander, and should, if the ground admits, consist of an exercise under brigade control.

### 36. Allotment of ammunition and summary of practices *Allotment of ammunition.*

	Rounds.
Part I—	
Each officer, N.C.O. and man ... ..	250
Part II—	
Each officer, N.C.O. and man ... ..	550
Part III—	
*Each officer, N.C.O. and man ... ..	100
Part IV—	
*Each officer, N.C.O. and man ... ..	150
Part V—	
*Each officer, N.C.O. and man ... ..	50

#### *Summary of Practices : Parts I, II, III, IV and V.*

No.	Nature of practice	Rounds for each man	Total rounds for each man
PART I.			
1	Grouping ... ..	20	—
2	Single shot traversing ... ..	20	—
3	Single shot searching ... ..	12	—
4A	Single shot oblique traversing ... ..	7	—
4B	Group oblique traversing ... ..	60	—
†5	Application and registration ... ..	60	—
6	Stoppages ... ..	30	—
Total for Part I ... ..		209	—
For testing mounting and gun, and repetition ... ..		41	—
Total for Part I ... ..		—	250

\* These rounds will not be fired individually, but will be expended collectively.

† Practice 5 will be fired in anti-gas respirators.

## Summary of Practices—continued. Parts II, III, IV, and V.

No.	Nature of practice	Rounds for each man	Total rounds for each man
PART II.			
7	Observation and registration (up to 1,000 yards) ... ..	50	—
*8	Ranging (400x) ... ..	30	—
*9	Application (400x) ... ..	30	—
*10	Traversing (400x) ... ..	70	—
*11	Ranging (600x) ... ..	30	—
*12	Application (600x) ... ..	30	—
*13	Traversing (600x) ... ..	100	—
*14	Service application (600x) ... ..	50	—
†15	Ranging (800x) ... ..	30	—
†16	Application (800x) ... ..	30	—
†17	Traversing (800x) ... ..	100	—
Total for Part II ... ..			550
Total, Parts I and II ... ..			800
PART III.			
	Fire at long ranges, observation of the fire of a section, demonstrations and tests, night firing and indirect fire ... ..	100	100
PART IV.			
	Tactical field firing ... ..	150	150
PART V.			
	Tactical field firing ... ..	50	50
Total for Parts, I, II III, IV and V ... ..			1,100

\* Classification practices.

† Fired in anti-gas respirators

## 37. Detail of Parts I and II and of Annual Machine-gun Course (Territorial Army).

## Part I.—Instructional.

To be fired at 25 yards range. Targets: M.G. for "Application and traversing" and "stoppages." (See Plate XXV, page 179.)

No.	Nature of practice	Target	Rounds	Object of practice and method of conducting
1	Grouping ...	Fig. I. Left target.	20	To find the sighting elevation necessary to hit the point of aim. Fired in two spaced groups of 10 rounds each, directed on two different aiming marks.
2	Single shot traversing	do.	20	To practise automatic tapping. Fired in two traverses of 10 single shots each, one to the right and one to the left.*
3	Single shot searching	do.	12	To practise automatic turning of the elevating wheel. Fired in two searches of six single shots each, one up and one down.*
4A	Single shot oblique traversing	do.	7	To combine automatic tapping with quick relaying. Fired at the seven aiming marks respectively.

\* Practices 2 and 3 will be fired concurrently, i.e., one traverse, one search going completely round the target. The firer must observe his target and not use his tangent sight (which, however, will remain raised), except for the initial laying at the commencement of each practice.

*Part I.—Instructional—continued.*

No.	Nature of practice	Target	Rounds	Object of practice and method of conducting
4B	Group oblique traversing	Fig. 1. Left target.	60	<p>To combine automatic tapping with quick relaying and control of the burst of fire.</p> <p>Fired in five bursts of about 12 rounds each at any consecutive five of these seven aiming marks respectively.</p>
5	Application and registration	Fig. 1. Right target.	60	<p>To teach (a) quick application of fire when the initial elevation is found to be at fault ; (b) registering the correct elevation, <i>i.e.</i>, alteration of the tangent sight slide and notifying to the instructor the correct elevation thus found.</p> <p>Fired in two series of 30 rounds each.</p> <p>Procedure : (i) The instructor indicates to the firer any two squares, explaining that the first indicated is a "ranging mark," while the second is the "target," against which fire is to be applied.</p> <p>ii. The instructor orders the sights to be set to a range which will cause the group to strike outside (above or below) the "ranging" square.</p>

*Part I.—Instructional—continued.*

No.	Nature of practice	Target	Rounds	Object of practice and method of conducting
5	<i>—continued.</i>			<p>iii. The firer lays the gun with the elevation ordered, on the centre of the ranging square and opens fire on the instructor's order.</p> <p>iv. After the first burst the firer corrects the error in elevation by means of the elevating wheel, without altering the tangent sight and corrects for direction, if necessary, by tapping. The firer will repeat the above procedure until the group is approximately in the centre of the aiming mark.</p> <p>v. The firer now "registers" the correct elevation by means of the tangent sight slide, and the correct direction (if necessary) by a gun-aiming mark, reporting to the instructor the sighting elevation and auxiliary point of aim (if any) found.</p> <p>vi. The firer now applies the balance of the 30 rounds to the square originally indicated as the target.</p>

## Part I.—Instructional—continued.

No.	Nature of practice	Target	Rounds	Object of practice and method of conducting
5	—continued			<p>Points for criticism at this stage of the practice :</p> <p>(a) Correct use of elevating wheel in correcting for ranging errors.</p> <p>(b) Tapping.</p> <p>(c) Procedure in registration.</p> <p>(d) Speed in application of fire on completion of registration.</p> <p>(e) Position of group on target.</p> <p>(f) Proportion of rounds used for ranging.</p> <p>vii. On completion of the first series the practice will be repeated, using the two remaining squares, and results criticised as before.</p>
6	Stoppages	Fig. 3	...	30
			Total rounds Repetition	209 41
			Total for Part I ...	250
				For each man.

## Part II.—Observation, Range and Classification.

No.	Nature of practice	Nature of target	Range, yards	Rounds	Time, secs.	Remarks
7	Observation	—	Up to 1,000	50	—	See Sec. 35, 5.
8	Ranging ...	—	400	30	—	Fixed sights. Ranging fire should be carried out against a bank of earth adjacent to the target, if possible. In this practice each man has the opportunity of sighting his gun on the open range before the classification practice.
9	Application	Large 6-ft. L.A. and M.G. target. Fig. 5.	400	30	10	Fixed sights. Only shots within the 5-ft. square count.
10	Traversing...	Screen comprising 2 L.A. and M.G. screens. Fig. 6.	400	70	25	Fixed sights. Gun to be traversed by groups from right to left; the firer is required to traverse the target with the rounds allotted within the time limit, without restrictions as to traversing backwards.
11	Ranging ...	—	600	30	—	See practice 9. Tangent sight used.
12	Application	As for 9 ...	600	30	10	Tangent sight used. All shots on the screen count.



*Part II.—Observation, Range and Classification—continued.*

No.	Nature of practice	Nature of target	Range, yards	Rounds	Time, secs.	Remarks
13	Traversing	Screen comprising 3 L.A. and M.G. screens. Fig. 6.	600	100	25	Gun to be traversed from left to right; tangent sight used. Other conditions are the same as for practice 10.
14	Service application	Equilateral triangle of 4 ft. 6 in. sides, mounted on pole. Fig. 4.	600	50	70	<p>The gun and tripod will be laid on the ground about 3 paces in rear of the spot on which the gun will be mounted, tripod on left of gun with legs to rear.</p> <p>Ammunition box in a convenient position on the firing point, i.e., close to where No. 2 will be in position after the gun is mounted. The sights will be set at zero.</p> <p>The limits between which his target will appear are pointed out to the firer: these limits should be about 30 yards apart.</p>

*Part II.—Observation, Range and Classification—continued.*

No.	Nature of practice	Nature of target	Range, yards	Rounds	Time, secs.	Remarks
14	—continued.					<p>The triangular target is hoisted at any spot between these limits on signal from the firing point. Exposure 70 seconds, after which target disappears. The gun is brought into action directly the target appears and fire is opened without further word of command.</p>
15	Ranging ...	—	*800	30	—	See practice 11.
16	Application	As for 9 ...	*800	30	10	See practice 12.
17	Traversing...	As for 13 ...	*800	100	25	See practice 13.

\* Where 800 yards range is not obtainable, these practices may be carried out on a field firing range, or the ammunition may be utilized for further training in practices of Part II at the discretion of the regimental or battalion commander.

Anti-gas respirators will be worn when firing practices 15, 16 and 17. Practice 17 will not be fired by first-year men, the 100 rounds thus saved being utilised for the first-year practices at 300 yards.

## ANNUAL MACHINE-GUN COURSE—TERRITORIAL ARMY

The Annual Machine-gun Course for the Territorial Army will be as follows :—

## PART I.

As for Regular Army. Total rounds for each man—250 rounds.

## PART II.

No. of practice	Nature of practice	Rounds for each man	Remarks
7	Observation (up to 1,000 yds.)	30	As for practice 7 Reg. Army.
*8	Ranging (400 yds.) ...	30	" 8 "
*9	Application (400 yds.) ...	30	" 9 "
*10	Traversing (400 yds.) ...	70	" 10 "
*11	Ranging (600 yds.) ...	30	" 11 "
*12	Service application (600 yds.)	40	" 14 "
Total rounds per man ...		230	

\* Classification practices.

## PART III.

Fire at long ranges, field practices, &c. (*see* Parts III and IV for Regular Army)—50 rounds for each man.

Total rounds for each man for Parts I, II and III—530 rounds.

## ANNUAL MACHINE-GUN COURSE, PART II (Territorial Army) adapted for firing on 30-yards ranges.

(Target see Plate XXV, Fig. 7, page 182.)

No.	Practice.	Target.	Rounds.	Time secs.	Method of conducting.
7	Application and Registration.	As for Prac. 5, Pt. I...	50	—	As for Prac. 5.
8	Ranging... ..	2" × 2" Aiming mark	10	—	As for Prac. 8 for Reg. Army, except that the 2" aiming mark is substituted for a ranging point on the earthbank. Fixed sights to be used.
9	Application ...	Brown patch 4" × 4" on grey ground.	30	10	As for Prac. 9 for Reg. Army. All shots in a 4" square to count. Fixed sights.
10	Traversing ...	Brown strip 15" × 2½" (subdivided into spaces of 1½" width) on a grey ground	70	25	As for Prac. 10 Reg. Army. Fixed sights.
11	Service application	Brown triangle 3" sides on grey ground	30	20	Gun to be mounted and loaded. Sights set to zero and layed well off the target. On the signal to open fire being given, sights will be set, gun layed on target and fire opened.
12	Service application	Brown triangle 3' sides on grey ground	40	70	The gun and tripod will be laid on the ground about 3 paces in rear of the spot on which the gun will be mounted, tripod on left of gun with legs to rear. Ammunition box in a convenient position on the firing point, i.e., close to where No. 2 will be in position after the gun is mounted. The sights will be set at zero. On the signal to open fire being given, the gun will be brought into action and fire will be opened without further word of command. 70 seconds will be allowed from the signal to open fire being given.

NOTES.—i. *Scoring.*Prac. 8, 9, 10, 12, as for Prac. 8, 9, 10, 14, Reg. Army.  
Prac. 11, 2 points per hit.ii. *Classification.*1st Class Machine Gunner ... .. 130  
Qualified Machine Gunner ... .. 90

## ANNUAL MACHINE-GUN COURSE, PART II (Territorial Army) adapted for firing on 30-yards ranges.

(Target see Plate XXV, Fig. 7, page 182.)

No.	Practice.	Target.	Rounds.		Time secs.	Method of conducting.
7	Application and Registration.	As for Prac. 5, Pt. 1...	50	—	—	As for Prac. 5.
8	Ranging...	2" × 2" Aiming mark	10	—	—	As for Prac. 8 for Reg. Army, except that the 2" aiming mark is substituted for a ranging point on the earthbank. Fixed sights to be used.

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In order to be classified as a—

1st class machine gunner—100 points must be obtained.

Qualified machine gunner—70 points must be obtained.

Those who obtain less than 70 points will be unqualified and will be put back for further instruction.

38. *Vickers machine-gun refresher course for reserve machine gunners with units*

Course for category "R" soldiers.

*Practices. (30-yards range.)**No. 1—Grouping.*

20 rounds.—As for practice No. 1 of Part I, Annual Machine-gun Course.

*No. 2.—Single Shot Traversing.*

10 rounds.—As for practice No. 2 of Part I, Annual Machine-gun Course, but only one traverse either to the right or left.

*No. 3.—Single Shot Searching.*

6 rounds.—As for practice No. 3 of Part I, Annual Machine-gun Course, but only one search either up or down.

*No. 4.—Single Shot Oblique Traversing.*

7 rounds.—As for practice No. 4a of Part I, Annual Machine-gun Course.

*No. 5.—Application and Registration.*

57 rounds.—As for practice No. 5 of Part I, Annual Machine-gun Course.

Total rounds—100.



Course for category "L" soldiers.

*Part I. (30-yards range.)*

*No. 1.—Single Shot Traversing.*

10 rounds.—As for practice No. 2 of Part I, Annual Machine-gun Course, but only one traverse to the right or left.

*No. 2.—Single Shot Searching.*

6 rounds.—As for practice No. 3 of Part I, Annual Machine-gun Course, but only one search, either up or down.

*No. 3.—Single Shot Oblique Traversing.*

7 rounds.—As for practice No. 4a of Part I, Annual Machine-gun Course.

*No. 4.—Application and Registration.*

20 rounds.—As for practice No. 5 of Part I, Annual Machine-gun Course.

*No. 5.—Stoppages.*

17 rounds.—As for practice No. 6 of Part I, Annual Machine-gun Course.

Total rounds for Part I—60.

*Part II. (Classification range.)*

*No. 6.—Ranging—400 yards.*

30 rounds.—As for practice No. 8 of Part II, Annual Machine-gun Course.

*No. 7.—Application—400 yards.*

30 rounds.—As for practice No. 9 of Part II, Annual Machine-gun Course.

*No. 8.—Traversing—400 yards.*

70 rounds.—As for practice No. 10 of Part II, Annual Machine-gun Course.

*No. 9.—Ranging—600 yards.*

30 rounds.—As for practice No. 11 of Part II, Annual Machine-gun Course.

*No. 10.—Application—600 yards.*

30 rounds.—As for practice No. 12 of Part II, Annual Machine-gun Course.

*No. 11.—Traversing—600 yards.*

100 rounds.—As for practice No. 13 of Part II, Annual Machine-gun Course.

*No. 12.—Service Application—600 yards.*

50 rounds.—As for practice No. 14 of Part II, Annual Machine-gun Course.

Total rounds for Part II—340.

*Note.*—Category "L" machine gunners will be classified on Part II, the points for classification being as laid down for the classification practices of Part II, Annual Machine-gun Course. The results will be recorded on A.F. B 192M, but shown distinct from the results of soldiers still serving with the machine-gun squadron or platoon. These scores will not be included in the average for the machine-gun squadron or platoon.

## 39. Description of targets

## PLATE XXV

## Part I.

*Target frame.*—The screen required for mounting the targets for practices 1 to 5, Part I., is shown in Fig. 1. On this frame two targets are set up as described by Fig. 1.

Practices 1, 2, 3, 4a, and 4b are fired on the left target and practice 5 on the right target. Dimensions are given in Fig. 2 of the left target.

The target for practices 1, 2, 3, 4a and 4b (see Fig. 2) consists of a number of bulls'-eyes  $1\frac{1}{4}$  inches in diameter.

Practice 6 is fired at the M.G. Stoppage Targets, Fig. 3.

## Part II.

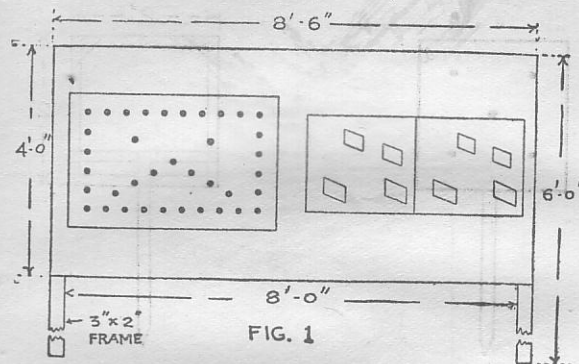
*Practice 9: Application: 400 yards.*—Is fired at a large (6 foot) L.A. and M.G. target (see Fig. 5). A blue pencil line will be marked 6 inches from the edge of the target all round. A 5-foot square is thus formed, and for this practice only hits within this square will count.

*Practice 10: Traversing: 400 yards.*—Two screens comprising 2 L.A. and M.G. screens, each 3 feet by 10 feet. Each screen is divided into six equal spaces by five vertical lines ruled 20 inches apart.

A 6-inch horizontal band of grey paper is pasted on to the two screens, the bottom of the band being 18 inches from the bottom of the screen (see Fig. 6).

*Practice 12: Application: 600 yards.*—The same target is used as for practice 9. All hits on the target will count.

PLATE XXV.—ANNUAL MACHINE-GUN COURSE TARGETS  
M.G. TARGET FOR APPLICATION AND TRAVERSING  
PRACTICES (PART I).



DETAILS OF LEFT TARGET ABOVE.

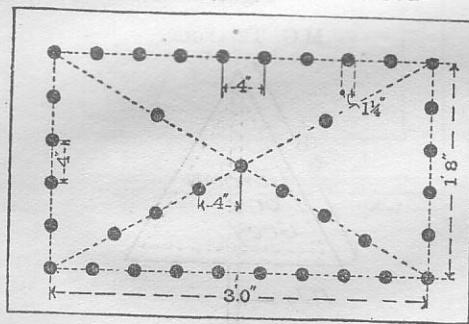


FIG. 2

PLATE XXV.—ANNUAL MACHINE-GUN COURSE TARGETS—  
*continued.*

M.G. STOPPAGES TARGET. BLACK AIMING MARKS ON  
WHITE GROUND.

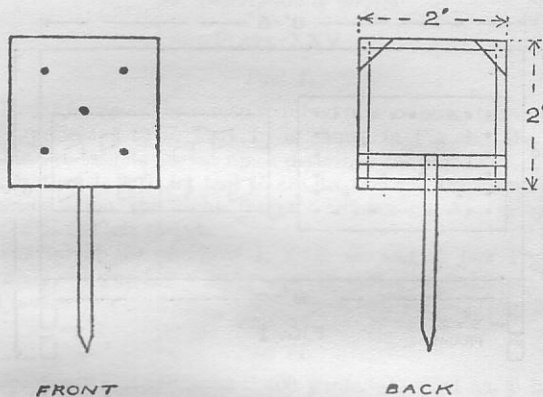


Fig. 3.

M.G. TRIANGLE.

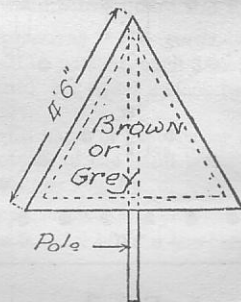


Fig. 4.

PLATE XXV.

ANNUAL MACHINE-GUN COURSE TARGETS (*continued*).

"LARGE" (6 FOOT) L.A. AND M.G. TARGETS.

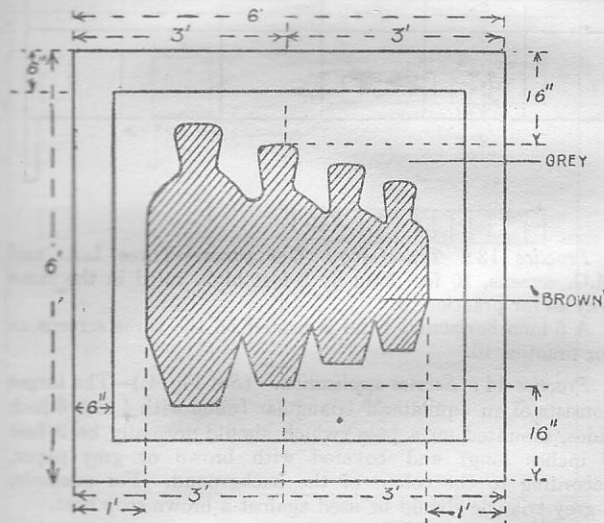


Fig. 5.

PLATE XXV.  
ANNUAL MACHINE-GUN COURSE TARGETS (*continued*).  
L.A. AND M.G. SCREEN

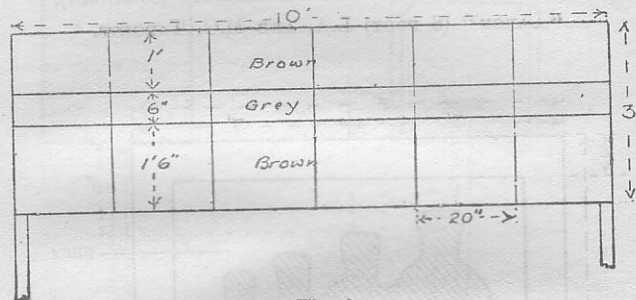


Fig. 6.

*Practice 13: Traversing: 600 yards.*—Three L.A. and M.G. screens, 10 feet long by 3 feet high, ruled in the same way as for practice 10.

A 6 inch horizontal band is pasted on the three screens as for practice 10.

*Practice 14: Service application.* (See Fig. 4.)—The target consists of an equilateral triangular frame with 4 feet 6 inches sides, mounted on a pole (which should normally be 9 feet 6 inches long) and covered with brown or grey paper, according to the colour of the background. For example, a grey triangle should be used against a brown stop butt.

*Practice 16: Application: 800 yards.*—The same target is used as in practice 9. All hits on the target will count.

*Practice 17: Traversing: 800 yards.*—Three screens, 10 feet long by 3 feet high. See practice 13.

*Note.*—The legs of the target frames for application and traversing practices must be sufficiently long to keep the frames upright when standing in sockets prepared on the face of the stop butts.

PLATE XXV.  
M.G. TARGET FOR PART II (TERRITORIAL ARMY) ON 30-YARDS RANGE.

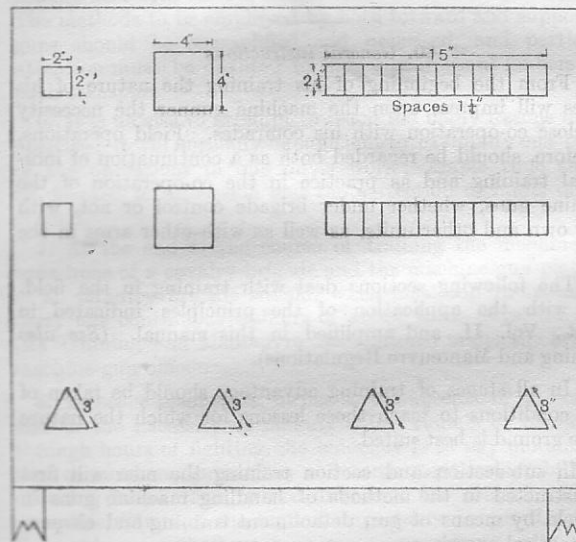


Fig. 7.

Target frame as in Fig. 1 faced with grey paper. Targets of brown paper.



## CHAPTER VIII

### TRAINING IN FIELD OPERATIONS

#### 40. General instructions

1. From the beginning of his training the nature of his duties will impress upon the machine gunner the necessity for close co-operation with his comrades. Field operations, therefore, should be regarded both as a continuation of individual training and as practice in the co-operation of the machine guns, whether under brigade control or not, with their own and other units, as well as with other arms in the field.

2. The following sections deal with training in the field, and with the application of the principles indicated in F.S.R., Vol. II, and amplified in this manual. (*See also Training and Manœuvre Regulations*).

3. In all stages of training advantage should be taken of local conditions to teach those lessons for which the nature of the ground is best suited.

4. In sub-section and section training the men will first be instructed in the methods of handling machine guns in the field by means of gun detachment training and elementary tactical exercises.

When the machine-gun squadron (*see* Sec. 2, 3 Note) or platoon commander considers that his troops or sections are

fit to take their place in the squadron or platoon the latter will be exercised as a whole.

5. Schemes for the training of the machine-gun squadron or platoon, either when working with its regiment or battalion or when under brigade control, should be simple, and should usually deal with various situations in either attack or defence. The methods to be employed by both forward and supporting guns should be exemplified and practised, and particular attention must be devoted to the tactical use of limbers and pack transport.

6. It is unwise to attempt to teach too many lessons in one exercise; it will normally be sufficient to exemplify one phase of the operations in one day's work; ample time should be devoted to discussion and the correction of faults on the ground.

7. At the end of the course of training the machine-gun squadrons of a cavalry brigade and the machine-gun platoons of an infantry brigade should, when local conditions admit, carry out continuous training of about three days' duration (*see Training and Manœuvre Regulations*) under the brigade machine-gun officer.

8. In peace operations, owing to the absence of fire effect, and to the necessity of making a few rounds of blank last through hours of fighting, the tendency is to pay more attention to numbers, formations and consequent vulnerability of opposing forces than to fire direction, fire control and fire discipline. It is of the highest importance to guard against this tendency, and all machine-gun commanders at all periods of training in the field should devote special attention to ensuring that the principles of fire tactics are correctly taught

and applied, so that neither bad habits are acquired nor false lessons deduced from the more or less artificial conditions of peace operations.

9. Exercises in the field will be carried out under service conditions as regards equipment unless climatic conditions make this inadvisable. Blank ammunition will be used in carrying out the more advanced exercises.

#### 41. *Training in use of ground and methods of advancing under fire*

1. The machine gunner will receive practical instruction in the use of ground. He should be taught that the use of ground, and of the cover it affords, is vitally necessary with a view to producing the maximum fire power with the minimum of exposure.

2. Ground and artificial features are used for concealment of :—

- i. Movement.
- ii. Gun positions.

As regards the latter it must be realised that the selection of a gun position is governed by facilities afforded for :—

- (a) Fire effect.
- (b) Concealment.
- (c) Cover from fire.
- (d) Inter-communication and ammunition supply.
- (e) Nature of the operation in hand.
- (f) Nature and morale of the enemy.
- (g) A suitable O.P.

3. Attention must be paid to the following points :—

- i. The use of ground to obtain the greatest possible concealment in approaching the position in readiness. To effect this the correct handling of limbers is essential.
- ii. The method of approach to the gun position as regards carrying the gun, tripod and ammunition boxes. Within reasonable limits, concealment is of greater importance than rapidity.
- iii. The difference between cover from view and cover from fire must be explained and, with regard to the former, the value of background in relation to the selection of a gun position in the open must be impressed on all ranks.
- iv. The value of camouflage must be demonstrated, and men must be practised in the use of simple and practical materials for the purpose (*see Manual of Field Works (All Arms)*).
- v. Instruction must be given in methods of concealment from aircraft, by troops on the move or when at rest.
- vi. Movement in the vicinity of the gun position must be avoided as much as possible.

4. The loads carried by machine gunners in action render the gun detachment conspicuous.

On occasions, therefore, when man-handling is necessary, within view of the enemy, the gun detachment should simulate the formations and movement of any other dismounted troops which may be moving in the vicinity at the time.

#### 42. *Training in reconnaissance and instruction of scouts*

1. Whilst all ranks should be trained in reconnoitring, observing and reporting the result of their observations, the training of the machine-gun officer in reconnaissance is of great importance.

Officers who may be called upon to carry out reconnaissances should be capable of executing rough maps and of writing a concise report containing only such information as will be of use to the officer for whom it is intended, and which is relevant to the object in view. If an area is being reconnoitred for machine-gun positions the report should commence with a brief description of the area reconnoitred and of the positions available, with their special advantages or disadvantages.

2. In the actual reconnaissance of localities for gun positions, attention should be paid to the following points:—

- i. The field of fire must be adequate for the task in hand, and for effective co-operation with adjacent machine guns.
- ii. The selection of an observing post, which must be considered in relation to:—observation of our own troops: control of fire: observation of enemy troops (or the target): observation of fire.

(a) *Observation of our own troops.*—Is a vital factor in the selection of an observing post from which fire is to be controlled, *unless* a time table is in force (e.g., in the attack) or our own troops are stationary and their position is known accurately (e.g., in the defence). Even in the above cases observation of our own troops is highly desirable.

(b) *Control of fire.*—To be effective, control of fire must be immediate, especially with overhead fire.

This will only be the case if the control post (*i.e.*, the observing post) is sufficiently close to the guns to admit of control being exercised by *word of mouth* or by *direct visual signal*. Under the conditions mentioned in (a) above, or when our own troops are not in, or likely to be in, the line of fire (e.g., in the defence) an observing post may be selected at considerable distance from the gun position (if necessary) for the purpose of laying out lines of fire. In such cases observation of our own troops is not essential, and control of fire need not be exercised from the gun position.

(c) *Observation of enemy troops (or the target).*—Except when shooting entirely by the map, observation of the target is essential for the purpose of laying out lines of fire. This is, therefore, a primary factor in the selection of an observing post, whether fire is to be controlled from that observing post or not. Observation of the movement of enemy troops is desirable at all times, in order that important targets (e.g., counter-attacking troops) may be engaged.

(d) *Observation of fire* (see Sec. 30).—Facilities for the observation of machine-gun fire are limited. Therefore, in the selection of an observing post from which it is intended to control fire, the question of observation of fire is a secondary consideration. This does not preclude the use of an officer or

N.C.O. sent forward specially to observe fire; but in this case the deciding factor is the question of communications, i.e., whether the officer or N.C.O. in question will be able to communicate results of his observation to the officer controlling fire in time to be of use.

- iii. Cover, especially from view, should, whenever possible, be found for the position and its approaches, and for the gun detachment.

Fire effect, however, should rarely be sacrificed for the sake of cover.

- iv. A position in readiness must be selected, under cover, and close to the gun position, to which the squadron, platoon, or section can be directed prior to coming into action.

- v. The route of approach to the position in readiness, and from there to the gun position, should be under cover; for this, a detour may have to be made. Ease of inter-communication and supply will largely depend on the nature of the route selected. The fact that communications to alternative positions may be required must also be borne in mind.

- vi. Positions for transport must be found. Limbers or pack transport should be brought as close to the gun position as cover will allow, although, if the situation so demands, cover may have to be sacrificed to speed of action.

- vii. Arrangements must be made for local protection when in action. In this connection the question

as to whether an escort will be required must be considered.

- viii. When fire compels a change of position, the guns should be moved to an alternative position. This should be selected as soon as the original position has been chosen. There should be a covered approach, and, as nearly as possible, a similar field of fire to that of the original position.

- ix. Lines of advance or retirement to the next position must be selected.

3. The above instructions apply to officers, but in order that N.C.Os. and selected men employed on reconnaissance work may be of use to them, they will require training in the following subjects:—

- i. *Map reading*.—They should be able to find the way in a strange country, first, by practical map reading; then by memory of the map; by sun and compass; by landmarks; by questioning natives of the country. As maps may not always be available on service, they should be practised in working without their aid.

It should be a habit with them to notice the general direction taken and changes of direction subsequently made.

- ii. *Sketching*.—When they have learnt to read a map, elementary instruction in sketching should be given. This to include instruction in conventional signs; judging distances by time or by eye; making a simple approximate scale, finding approximate north point; sketching a piece of



simple country; drawing a map from memory; estimating heights.

iii. *Reporting*.—As the value of the men's work depends largely on their ability to furnish a clear report, they should receive instruction in this subject. Written reports should be in telegraphic language, and verbal reports thought out beforehand.

iv. *Concealment*.—Their attention should be drawn to the great importance of taking cover and of selecting a background to suit the colour of their clothing when observing; the importance of remaining perfectly still; of avoiding the sky line; of selecting look-out points when on the move, and of getting from one point to another quickly, and unseen.

4. In almost any given situation, prior to taking part in an attack, a machine-gun commander will be given definite tasks by the officer commanding the force with which he is co-operating. Having been allotted his task, the machine-gun commander will be allowed to carry it out in such a way as he may think best, subject to certain conditions of time and space, which will vary according to the nature of the operation. In most cases his task will have been allotted to him when he is still some distance from the enemy. Reconnaissance should be his first consideration, and the following description of the action of a troop or section commander under these circumstances indicates the procedure to be adopted normally:—

i. Explain thoroughly to his command the nature and scope of the task in hand, stating his intentions.

ii. Direct one of his N.C.Os. to lead the troop or section to a point (under cover from view of the enemy) in the direction of the locality where it is intended to come into action. This point may have to be selected off the map, but it will often be possible to indicate it on the ground. It should not be too near the locality selected for coming into action, in case change of direction is found necessary.

iii. Proceed as quickly as possible well ahead of his command to reconnoitre the enemy's position and the locality in which he is to come into action. During this reconnaissance he should be accompanied only by such men as are essential for the purpose and for communication between himself and his command, *e.g.*, one or two scouts and a range-taker.

iv. During the reconnaissance select a suitable line of approach for the troop or section from the point to which it has been directed to the actual gun position.

v. Select the gun positions with due regard to the task in hand. Indicate ranges to be taken by the range-taker.

vi. Send back one of the party to lead the troop or section into position. Look for alternative positions.

Many other minor details will require attention, but unless something like the above procedure is adopted the troop or section will blunder into action with correspondingly bad results.

5. In addition to the scouts and orderlies in squadron or platoon headquarters, at least one man for each gun detachment will be specially trained in the duties of scout; such training will be carried out principally during the period of individual training. This special training should be conducted by a selected officer, under whose charge all the above men should be placed for a definite period.

6. The methods to be adopted in the training of scouts should be left to the officers concerned. The standard to be aimed at is that a scout should fulfil the following conditions:—

- i. Be of thoroughly sound physique and in good condition.
- ii. Know how to observe.
- iii. Be able to read a map easily.
- iv. Know what to report on, and how to make a report.
- v. Be able to express himself clearly and concisely.
- vi. Possess good sight and know how to use his eyes and ears.
- vii. Be self-reliant, resourceful, and prepared to take risks.
- viii. Understand semaphore signalling, and, if possible, be acquainted with all methods of visual signalling.
- ix. Thoroughly understand the use of the ground; be able to move about and see without being seen.
- x. Be able to judge distance accurately and estimate numbers correctly.
- xi. Be able to form sound conclusions from signs, such as clouds of dust, footprints, and so on.
- xii. Understand how to guide himself by compass, by the sun and by stars.

7. The value of the work done by scouts depends to a very great extent on the orders they receive before they are despatched on a particular duty. Every party of scouts sent out must have a particular objective assigned to it, and must be given specific questions to answer. The role of scout is to observe and report, and, when engaged on their special duties, they will only use their weapons in self-defence.

The commander who despatches parties of scouts must arrange with them for means of rapidly communicating any intelligence gained.

During peace operations scouts should not be allowed to employ methods which would be impossible in war.

#### 43. *Field engineering: duties in billets, camps, or bivouacs: sanitation*

1. The machine gunner should have learned during the period of individual training how to use the various forms of tools, and the elementary principles of field fortification.

During his training in field operations, he should be taught to apply his knowledge to the construction of such field works as may be required to be undertaken by machine gunners in war.

2. Particular attention will be paid to the construction of such machine-gun emplacements as can be completed quickly in war without expert supervision or assistance. Details regarding such emplacements are laid down in the Manual of Field Works (All Arms). The general principles governing the siting of machine-gun positions are given in Sec. 107.

3. Instructions regarding duties in billets, camps or bivouacs are given in Chapter XIII, F.S.R., Vol. II, 1924.

4. The efficiency of a unit depends largely upon its general health. The preservation of health and the prevention of disease are therefore incumbent on every officer and soldier.

This can be secured only by strict adherence to the laws of sanitation. This subject is fully dealt with in the Manual of Military Hygiene, of which all ranks must have a general knowledge.

The idea that sanitation is the province of the medical service alone is entirely erroneous and must be strongly combated, as also must be the tendency to overlook its broader application and to regard it as dealing only with scavenging, disposal of refuse, and arrangements for conservancy.

Though much of the work of disease prevention is of a technical nature, which must be left to experts, all ranks should appreciate the reasons for the various sanitary measures taken, and should realise that disease is generally due to dirt, carelessness, or lack of discipline, and that they are personally responsible for whole-hearted co-operation in these methods, and that a low percentage of sick in their units is a sign of their unit's efficiency.

#### 44. *Training in marching*

1. The general rules and principles regarding marches and march discipline are laid down in Chapter XII, F.S.R., Vol. II, 1924, and amplified as regards the man in Infantry Training, Vol. I.

2. The power of undertaking long and rapid marches without loss in numbers and energy is one of the chief factors of success in war, and is as essential to the efficiency of the machine gunner as to that of the remainder of the battalion.

3. In addition to route marching in marching order, the machine gunner must be trained in carrying machine-gun loads over considerable distances, since his efficiency in battle will

largely depend on his ability to carry the gun, tripod and ammunition loads whenever conditions debar the use of limbers or pack animals.

4. The following rules will be observed by machine-gun units as regards the march discipline of transport and the care of animals :—

#### i. *Before starting.*

(a) Before commencing a march, commanders should make certain that harness and saddlery are correct, that shoeing has been properly attended to and that the animals are fit for the march. A small supply of bandages, old puttees and blankets is required for galls, &c.

(b) Even when marching at an early hour the animals should be watered and a small feed should be given before starting.

(c) Sufficient time should be allowed each morning for the men to saddle up carefully, but on no account should animals be harnessed up or hooked in an unnecessarily long time before starting.

#### ii. *At the halt.*

(a) A careful examination should be made of animals, harness, saddlery, and vehicles at every halt, especially at the first one. Drivers must be trained to examine their animal's feet and to report injuries, breakages, &c.; they must realise the importance of dealing with an incipient gall immediately it is noticed.

(b) At halts of 10 minutes or over, whenever the tactical situation allows, girths should be

slackened and poles lowered, but traces need not be unhooked, provided that brakes are put on and wheels scotched. It is of great importance to relieve horses or mules as much as possible of the heavy weights they have to carry. When they are standing in harness the drivers should be dismounted.

(c) Opportunities which may occur for watering and feeding should always be seized. Watering must be carried out on a regular system if it is to be done smoothly and expeditiously: it must be supervised by an officer. In dusty weather the eyes and nose should be sponged out whenever possible.

(d) At the halts, officers' chargers must be on the same side of the road as the rest of the column, and should face the centre of the road if standing on it. Care must be taken when continuing the march that officers' chargers do not block the road.

### iii. *During the march.*

(a) In all circumstances an even pace must be maintained throughout the column. If a check is unavoidable the suddenness of it may be reduced by pulling into the side.

(b) Drivers must ensure that all the animals in a team do their fair share of work; this cannot be obtained unless the former apply their legs and whips correctly.

(c) Drivers must not lounge in their saddles, as this is liable to cause sore backs.

(d) During training the position of mules or horses should frequently be changed: a led mule, for example, loses his back muscles if he is never ridden, and is also apt to acquire the habit of leaning on the off-side of the bit. This change of position may be necessary on a long march.

(e) The brake should be put on sufficiently tight to check but not to skid the wheels. In crossing a valley the brakesman must begin easing it off soon enough for the wheels to be quite free before the beginning of the rise on the other side is reached.

### 45. *Training in night work*

1 Night work must not be regarded as a separate operation of war, but as the natural sequence of operations carried out by daylight, and the soldier must be accustomed to perform after dark all the acts required of him by operations carried out in daylight.

2. Individual training in this respect will be commenced at an early stage, will be carried out progressively in the unit, and should embrace the following subjects:—

- i. Visual training.
- ii. Training in hearing.
- iii. Methods of advancing silently, carrying tools or machine-gun loads.
- iv. Training in orientation.
- v. Entrenching at night.



- vi. Training of transport in moving by night, including instruction in methods of obviating noise.
- vii. Use of pack transport, and changing from limbers to pack.

3. Since the co-operation required from machine guns in either attack or defence is limited to the production of fire, the importance of night firing (*see* Sec. 68) is evident, and the machine gunner must receive thorough instruction in the limitations of and methods to be adopted in carrying out night firing.

#### 46. *Posting and relief of sentries : relief of units*

- 1. The object of this instruction is to give practice in :—
  - i. Posting and relieving sentries, and Nos. 1.
  - ii. Relief of sections.
  - iii. Coming into action from cover.
  - iv. Quick changes to alternative positions.

#### 2. *Posting and relief of sentries by day.*

The following procedure will be carried out when relieving sentries within a gun detachment :—

The principles involved are identical with those for the posting and relief of a sentry on guard or outpost duty.

By day, one gun number only need be on duty at the gun position ; he is the sentry.

He will always be posted by a N.C.O., who will explain the orders to him, and be certain that these orders are understood.

The gun will be mounted and two belts in boxes will be in the position ; the remainder of the detachment and equipment will be under cover.

The sentry will be given the following details and orders :—

- i. Definite orders as to his action in case of attack.
- ii. Exact location of all gun positions allotted to his gun, and their numbers or names.
- iii. Points shown on the range card, and extent of the front to be watched.
- iv. In case of alarm, to warn the commander and detachment.
- v. Standing orders for sentries ; special orders for the gun position.
- vi. Special information—*i.e.*, patrols, wiring parties, danger from snipers, the position of our own and enemy infantry, &c.
- vii. Positions of guns on either flank.
- viii. Position of the officer.
- ix. Position of the nearest telephone and latrine.

#### 3. *Posting and relief of sentries by night.*

By night double sentries will always be posted, one being the No. 1 for the tour of duty. Both will be near the gun and on the look-out.

The gun will be mounted in the position, half loaded and layed on the night line. Four belt boxes and the spare parts case will be in the position.

The posting of the double sentries will be performed by a N.C.O., who will make certain that the sentries understand their orders.

Each No. 1, after being posted, will inspect the gun to make certain that it is in thorough working order and ready to open fire on completion of the loading motion. He will see that

all necessary equipment is in place, and will be informed of any special fire orders for night firing from the position.

*Note.*—All sentries, both by day and night, will also act as gas sentries.

#### 4. Relief of sections.

The guide with the relieving section will lead it to the position of the section to be relieved, and report to the commander of that section that the relieving section has arrived.

##### i. The officer in charge of the relieving section will :—

- (a) Report to the officer of the section to be relieved.
- (b) Remain with him and receive reports from his N.C.Os.

- (c) Receive any instructions or information with regard to the situation, other than those he has learnt during his previous reconnaissance.

- (d) As soon as the relieved section has moved off he will go round all his guns and make sure that his gun-detachment commanders have carried out their work correctly. At the same time he will see that any special orders he may have issued with regard to work to be done, &c., are being complied with.

- (e) Report "Relief complete" to his platoon commander.

- (f) See that his arrangements for communication are on a satisfactory basis.

##### ii. The relieving N.C.O. will :—

- (a) Ascertain the positions of the guns and the sentries, alternative emplacements, his officer's

headquarters, the nearest telephone and the latrine. He will also ascertain the night lines for the guns.

- (b) Take over and give a receipt for trench stores.
- (c) Ensure that his Nos. 1 understand their orders and range card, and show them the alternative emplacements.
- (d) Detail his first sentries, and see that they are properly posted.
- (e) Order his Nos. 1 to mount their gun, and see that this is done correctly.

*Note.*—When the relief is by night precautions must be taken that the incoming guns are layed on the correct line. (See Sec. 68.)

- (f) Report to his officer "Relief complete."

- (g) Draw up a duty roster.

##### iii. The officer in charge of the section relieved will not move off until his section is reported closed up and complete.

5. The relief of units larger than a section should be carried out on lines similar to the above.

#### 47. Duties in case of gas alarm or gas attack

##### 1. Duties in the case of alarm "Gas" or "Gas shells."

- i. All ranks will adjust their box respirators. The gun and spare parts will be well oiled.
- ii. *By day.*—On the alarm being given, the sentry gives the alarm to the other numbers, completes the

loading motions and lays. No. 2 immediately takes post at the gun, and the remaining numbers stand by under cover.

When "stand to" is ordered, the above procedure is carried out by the machine-gun detachments, but the gun is only half loaded.

- iii. *By night*.—On the alarm being given, No. 1 completes the loading motions. The other sentry will waken the other numbers, and return to his post.

## 2. Action during and after a gas attack.

- i. During a gas attack the gun, ammunition boxes, and spare parts case will be completely covered with ground sheets or blankets.
- ii. After a gas attack, the gun, its equipment and the ammunition will be thoroughly cleaned. (Sec. 52. Handbook for the 303-in. Vickers Machine Gun, 1923.)

## PART II.—FIRE CONTROL

### CHAPTER IX

#### GENERAL CONSIDERATIONS

##### 48. Introduction

I. The main object of all fire is to cover the movement of our own troops and prevent the movement of the enemy.

The duty of machine-gun squadrons or platoons is to support the troops with which they are co-operating, by assisting them to gain superiority of fire. To carry out this role successfully, volume of fire is essential. To obtain the requisite volume of machine-gun fire it is necessary to have a number of guns under one control. In the infantry the section of four guns is the smallest unit which can be relied on to produce fire effect at all machine-gun ranges, but for purposes of concealment it will generally be necessary to occupy sub-section positions especially when acting as forward guns. This will result in the sub-section becoming the fire unit; but the fire of two or more sub-sections can, when necessary to obtain fire effect, be directed on to the same target from their respective fire positions.

2. The method by which the range is obtained, the distance to the target, and the width and depth of the area which it is necessary to engage in order to ensure fire effect, are the main factors to be considered in determining the number of guns required for a given task.

One sub-section (*i.e.*, two guns) cannot be relied on to obtain results proportionate to the expenditure of ammunition at distances beyond 1,200 yards.

The employment of guns singly leads to difficulty of supply, lack of control and dissipation of fire power, and must therefore be avoided.

The section is the largest unit which can be controlled by one person. The section commander directs the fire action of his two sub-sections, but only under exceptional circumstances can he actually control their fire.

3. Owing to the peculiar role of cavalry, which normally entails the dispersion of the squadrons of a regiment and the consequent necessity of providing machine-gun support to each squadron, it will seldom be possible, except under the conditions of the defence in position warfare, to employ more than two guns under one fire commander. For these reasons the troop of two guns is the normal fire unit. The limitation of the troop as regards fire power is as given above.

4. Before commencing the study of fire control the student must be thoroughly familiar with elementary ballistics (*see* Sec. 49).

A thorough knowledge of topography and of elementary mathematics is also essential to the machine-gun officer; he must be able to use a prismatic compass with accuracy, and must be trained to recognize ground features as they appear

on maps of various scales. A fair knowledge of field sketching is also of advantage to him.

#### 49. Elementary ballistics

1. *Rifling*.—A gun barrel is said to be rifled when it has spiral grooves cut down the "bore." Rifling a barrel enables an elongated bullet to be used; the advantage of this form of bullet is that it has great weight in proportion to the surface directly opposed to the air. It has, therefore, greater power of overcoming the resistance of the air, thus keeping up its velocity. When the charge is fired the bullet is forced into and follows the grooves up the barrel, thus leaving the muzzle with rotation on its longer axis. This tends to keep its point foremost and therefore to ensure accuracy of flight.

2. *Forces acting on the bullet*.—Three forces act on the bullet—the explosion of the charge, gravity, and the resistance of the air. The explosion of the charge drives the bullet forward. Gravity, *i.e.*, the natural attraction which draws all unsupported bodies towards the centre of the earth with ever-increasing velocity, acts on the bullet continuously. The resistance of the air causes the velocity of the bullet to decrease rapidly.

3. *Trajectory*.—The combined effect of these forces causes the bullet to travel in a curved line called the trajectory, the curvature of which becomes more pronounced the longer the bullet is exposed to their action.

4. *Elevation*.—In order to allow for the fall of the bullet, it is necessary that the axis of the barrel be directed at a point above the object to be hit. This raising of the barrel to allow for the curve of the trajectory is termed "giving elevation."



The target must of necessity be kept in view ; the gun is therefore provided with sights which permit the firer to give the elevation required whilst keeping his eye fixed on the mark.

5. *Sighting of guns.*—In the sighting of machine guns a "mean" graduation for each range has been adopted, and a high general standard of accuracy for all practical purposes is thus obtained. Each machine gun is carefully tested before issue, but it must be understood that no two machine guns behave in an exactly similar manner, and that even if compensation could be made for every error in the sighting of the gun before issue, the wear of mechanism and barrels, the packing of barrels and other adjustments, the wearing of the gun mounting, &c., would combine to bring about faults from time to time. It is therefore necessary that every machine gunner should study from the first the shooting and peculiarities of his gun, and make himself thoroughly acquainted with any incorrectness of the graduations marked on the tangent sight in order that he may be in a position to give his gun the correct elevation for the estimated or ascertained range to the target. Further, it should be explained to the machine gunner that, owing to the close grouping of machine-gun fire, ignorance on his part of the correct sighting elevation of the gun may result in partial or even total loss of effect.

6. *Jump.*—Owing to the shock of discharge a vibratory or wavy motion is set up in the barrel at the moment the bullet leaves the bore, and the muzzle is usually deflected from its original axis. It therefore rarely happens that the line of departure coincides with the axis of the barrel before firing, and the angle between the two is known as the angle of jump. Jump may be either positive or negative, according to

whether the muzzle is deflected upwards or downwards with reference to the axis of the barrel. With Mark VII ammunition, which gives a muzzle velocity of 2,440 feet a second, the jump is "negative" in Maxim and Vickers guns, and is allowed for in the sighting. Lateral jump has also to be considered, but as variations can be allowed for by adjusting the position of the foresight to the right or left, it is of less importance.

7. *Drift.*—Drift is the term used to express the lateral deviation of the bullet after it has left the barrel. Owing to the rifling of the barrel causing the bullet to rotate during its flight, the bullet deviates laterally from a line in prolongation of the axis of the barrel. The rifling of the machine-gun barrel is left-handed, which results in the bullet drifting to the left.

The deflection due to drift at distances below 1,000 yards is negligible. At 1,500 yards it may be regarded as about 7 feet.

8.—*Normal rates of fire are :—*

- i. Slow fire: 60-75 rounds a minute. This is the rate for long period barrage fire.
- ii. Medium fire: about 125 rounds a minute. This is the rate which can be used to speed up slow fire for short periods. It can be maintained for about half an hour, and should not be attempted for a longer period.
- iii. Rapid fire: 250-300 rounds a minute. This rate is used when the situation demands it, but should only be maintained for a few minutes, after which the rate should be reduced to medium or slow rate.

iv. Harassing fire: 1,000 rounds an hour. This may be carried out in bursts at slow, medium, or rapid rates.

#### 50. Fire effect in relation to slope of ground

1. On level ground the length of the beaten zone varies considerably with the range; but also at any particular range the length of the beaten zone varies with the inclination of the ground to the line of sight.

2. A forward slope, as shown at AN in Fig. 17, will have the effect of shortening the beaten zone on the ground: a reverse slope, as shown at AR, lengthens it.

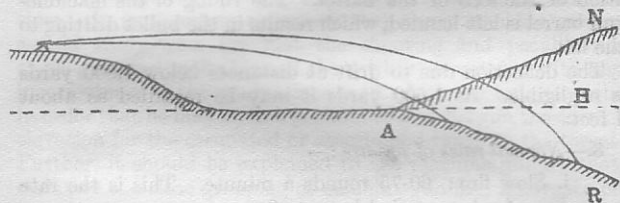


FIG. 17.

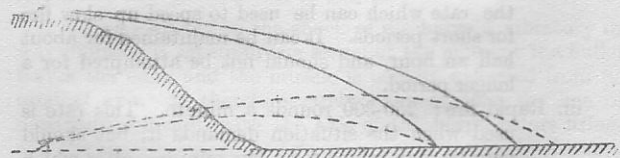


FIG. 18.

Similarly, the beaten zone of a gun firing from a commanding position on to level ground will be shorter than that of a gun firing, at the same range, from a position on the same level as the ground on which the beaten zone falls (see Fig. 18).

3. As an approximate guide to the amount of reduction or increase in the case illustrated in Fig. 17 above, the table given in Appendix IV has been compiled by graphical methods.

The method of use is best illustrated by an example—

- i. Range, 2,000 yards: gradient of forward slope (such as AN, Fig. 17), on which shots are falling, is found from the map to be 1 in 20; the beaten zone at 2,000 yards is 130 yards long: from the table, the factor in the vertical column under "2,000" opposite "forward slope  $\frac{1}{20}$ " is 0.78. The beaten zone on the slope will be  $130 \times 0.78 =$  say, 100 yards.

#### 51. Climatic and other influences and their allowances

1. The following are the normal conditions for the sighting of small arms—

- i. Barometric pressure. 30 inches. (Mean Sea Level.)
- ii. Temperature. 60 deg. Fahrenheit.
- iii. Still air.
- iv. A horizontal line of sight.

With reference to i, ii and iii, variations from the normal may sometimes be obtained by "meteor wire." (See Sec. 13, Artillery Training, Vol. II, 1923.) If this is not available, valuable information can often be obtained from the artillery.

2. *Atmospheric variations which affect elevation and direction.*

When the barometer rises above 30 inches, more elevation than is normally required for the distance will be necessary, owing to the greater resistance offered to the bullet by the denser atmosphere. If the barometer falls below 30 inches, or at a height above mean sea level, less elevation will be required, as the atmosphere will offer reduced resistance to the bullet. In the same manner the bullet meets with less resistance in hot weather when the thermometer is high, and greater resistance in cold weather when it is low.

3 Winds from front or rear also demand allowances in elevation.

Side winds affect direction and are a much more difficult problem.

The effect of winds is far greater at long ranges than at short, owing to the greatly increased time of flight allowing the wind much more time during which to act on the bullet.

4. The machine-gunner's slide rule enables the necessary allowances for the variations to be rapidly ascertained. (See Sec. 76).

5. The graph of allowances for climatic variations (see Appendix V) also enables corrections for temperature and barometer heights to be calculated rapidly, and also shows the allowances necessary for winds.

It is used as follows :—

i. *Barometer curve.*

This gives the allowance necessary for a variation of one inch from the normal, *i.e.*, for a barometrical pressure of 29

inches or 31 inches. If the barometer stands below normal, the allowance must be deducted ; if above, added.

For variations of more than 1 inch a proportionately greater allowance than that given by the curve must be made.

ii. *Temperature curve.*

This gives the allowance necessary for a variation of 20 deg. from the normal, *i.e.*, for a temperature of 40 deg. or 80 deg. Fahrenheit. If the temperature is below normal, the allowance must be added ; if above, deducted.

For variations of more than 20 deg. a proportionately greater allowance than that given by the curve must be made.

*Note.*—Variations of less than 1 inch in the barometer or 20 deg. in temperature need not be considered, unless they give allowances which have both to be added or both deducted.

iii. *Head or rear wind curve.*

This gives the allowance necessary for a wind of 20 miles an hour. For a head wind, add the allowance ; for a rear wind, deduct. For a wind of greater or less strength a proportionately greater or less allowance than that given by the curve must be made.

iv. *Side wind curve.*

This gives the allowance necessary for a wind of 20 miles an hour blowing at right angles to the line of fire. It is applied as a deflection towards the flank from which the wind is blowing. For a wind of greater strength a proportionately greater allowance than that given by the curve must be made. For a wind of less strength a proportionately less allowance than that given by the curve must be made.

Halve the allowance for oblique winds.

### 6. *Effect of not having a horizontal line of sight.*

i. As previously stated, one of the normal conditions under which a machine gun is sighted is that the line of sight shall be horizontal. When this condition obtains, the forces acting on the bullet cause it to travel on its greatest curve, and the normal tangent angle for any given distance must therefore be given to the gun.

ii. When firing up or down hill, the tangent elevation required gets less as the angle of sight increases, until when firing vertically upwards or downwards no tangent elevation is required at all.

Normally, it will seldom be found necessary to engage a target at an angle of sight of more than 10 deg., and it also happens that no allowance need be made for angles of sight less than 10 deg. In mountain warfare, however (*e.g.*, on the Indian frontier) it will frequently be necessary to fire at very steep angles : for this purpose a chart of corrections is given in Appendix XIV.

### 52. *Factors to be considered in the application of fire*

1. *Frontal, enfilade or oblique fire.*—The beaten zone of the machine gun is very long in comparison to its width. This factor must be borne in mind in considering the application of fire in relation to the tactical situation, the nature of the target and the number of guns available for the task in hand. Thus, a purely linear target may often be engaged in the most economical manner by means of enfilade fire, especially at close ranges. If, however, the object in view is to engage an area approximately equal in width and depth, it is immaterial whether frontal or enfilade fire is employed. Similarly, if it is

desired to prevent the advance of the enemy on a given frontage (*i.e.*, a linear target having depth), frontal fire, provided that sufficient guns are available, may be more effective than enfilade fire. Generally speaking, opportunities for the employment of enfilade or oblique fire will be found more frequently in the defence than in the attack.

2. *Errors of direction.*—The usual cause is wind. The machine-gunner's slide rule (*see* Sec. 76) and the graph (Appendix V.) show the lateral deflections necessary when the velocity of the wind is known. Owing, however, to the difficulty of correctly estimating this velocity, it will seldom be possible to make certain of striking a definite point by firing on it continuously with the same point of aim, unless observation of fire can be obtained. Every effort should be made to obtain observation of fire, as by so doing all errors, whether of direction or elevation, can be eliminated. This subject is dealt with in Sec. 30. Unless observation can be obtained on the target, it is necessary to direct fire, not only on what is believed to be the correct point of aim, but also on points to the right and left. The result of this is that a greater width of ground is engaged, thus making sure that the target has been included. In such circumstances fire should be applied up to the desired amount right and left, the order given to the guns being in *direct* fire "RIGHT AND LEFT . . . TAPS," and in *indirect* fire "RIGHT AND LEFT . . . DEGREES (OR MINUTES)" (*see* Sec. 62).

3. *Errors of elevation.*—These are caused by :—

- i. The difficulty of finding the correct range to the target; and
- ii. Climatic variations.



Unless observation can be obtained and all errors eliminated, as explained in the preceding paragraph, it may be necessary to fire not only with the estimated correct elevation, but also with greater and less elevations. The result of this is that a depth of ground greater than that of the beaten zone will be engaged, thus making sure that the target has been included.

The necessity or otherwise for adopting this procedure is discussed in the following paragraphs.

#### 4. Permissible and probable errors in range-finding:—

##### i. Permissible error in range-finding—

Suppose a target to be engaged which is 1,800 yards away (Fig. 19). Then, if the centre of the beaten zone hits the target (T), the lowest shot of the beaten zone will hit the ground 70 yards short of the target, and the highest shot 70 yards beyond the target, because the length of the beaten zone at 1,800 yards is 140 yards.

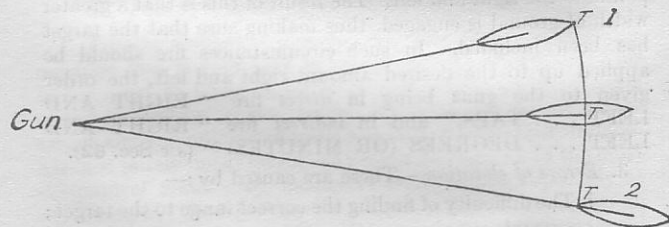


FIG. 19.

If the centre of the beaten zone falls 70 yards short, the highest shot only will hit the target (T1).

Or if the centre of the beaten zone falls 70 yards beyond the target (T2), only the lowest shot will hit the target.

It is clear then, that if an error of more than 70 yards is made in obtaining the distance to the target (T), the whole of the fire effect will be lost, because the target will not be hit. Seventy yards can be called the permissible error, and it is half the length of the beaten zone.

In general, the length of beaten zone decreases, as the range increases, and consequently the permissible error *decreases* as the range increases.

ii. *Probable error in range-finding.*—The range to any given target can rarely be obtained with complete accuracy, and the magnitude of this probable error depends on the method employed in obtaining the range.

The following table will act as a rough guide:—

- |   |                      |
|---|----------------------|
| (a) Using range-finding instrument, 5 per cent. error.  |                      |
| (b) Using a range card built up from key ranges, the key ranges being found by instrument, and the intermediate ranges by judging |                      |
| distance ... ..   | 10 per cent. error.  |
| (c) Judging distance (by eye) ... ..  | 15 per cent. error.  |
| (d) Using 1/10,000 map ... ..   | } Within 5 per cent. |
| (e) Using 1/20,000 map ... ..   |                      |

This means that a target can never be considered as a point, for there will always be a certain length in which the target may lie.

*For example.*—Suppose with a range-finding instrument it is found that the range to a certain target is 1,800 yards (Fig. 20).



FIG. 20.

Then, as an error of 5 per cent. (=90 yards) may have been made either way, the target may lie anywhere between the points A and B which are 1,710 yards and 1,890 yards respectively from the gun.

To ensure effect it will therefore be necessary to include the line from A to B in the beaten zone, which must be at least 180 yards in length, *i.e.*, twice the probable error.

At a range of 1,800 yards the beaten zone is 140 yards long. It is, therefore, obvious that unless the beaten zone at the range employed is at least twice as great as the probable error in range-finding, fire will not necessarily be effective. Should the beaten zone at the range employed not be of sufficient length to fulfil the above conditions, some means of increasing its length must be adopted. The methods by which this can be effected are dealt with in Secs. 53 and 54.

5. *Time required for production of effective fire.*—The slope of descent and the size of the beaten zone at each particular range, as well as the rate of fire, are factors which must be considered in determining on the time required for the production of effective fire.

6. *Observation of fire.*—Owing to the difficulty of observation of fire, corrections after fire is opened will frequently be impossible. The effectiveness of the fire will therefore depend mainly on the initial accuracy of the direction and elevation given to the guns.

### 53. Combined sights

1. The full surprise effect of machine-gun fire can only be obtained if the target is included in the beaten zone when fire is opened or immediately afterwards. (*See* Sec. 31, 5.)

To ensure this, at ranges of more than 1,500 yards, the beaten zone must be increased to overcome errors of range finding and to include the depth of a target, while the maximum traverse given to any gun should not exceed 50 yards.

2. To overcome these errors it is necessary to combine sights, that is to say, a different elevation is ordered to two or more guns with one point of aim (*see* Figs. 22 and 24). Para. 4 below gives a rough guide as to the number of elevations necessary to ensure striking a point. Differences of 100 yards will normally be employed, observations looked for, and the correct range being ordered as soon as obtained.

When sub-sections are given different points of aim (Sec. 55, 5) each gun of a sub-section will be given a different elevation.

For indirect fire see Sec. 61, 4.

3. Combined sights can also be employed to include the depth of a target, the section or the sub-section being given a point of aim on the near edge and different elevations ordered (see Figs. 23 and 24). This method is only effective if the target is on fairly level ground as viewed from the gun position, the foreshortening of the beaten zone and differences in angle of sight making one point of aim useless.

Deep targets on a forward slope should either be engaged in depth (e.g., one sub-section near edge, one far edge) or searched (Sec. 54). In the latter case surprise effect will be lost and lifts must allow for loss of angle of sight.

4. When the fire-unit commander is faced with the problem of a target which has width and depth, and for which it is necessary to combine sights, he should first decide on the number of points of aim necessary to cover the width (e.g. 90 yards - Two), then decide on the number of elevations necessary to overcome errors in range-finding to each point of aim. In this way the near edge, probably the most dangerous, is considered first.

If all guns are not required to engage the near edge the remainder can be given different elevations to bring fire on the target.

If the whole target is not then engaged it will be necessary to search by lifts (Sec. 54).

5. The following table gives rough rules as regards the elevations to be used for overcoming errors in range-finding.

It does not allow for any errors which may arise due to inaccurate computations for climatic variations (see Sec. 51).

Estimated range	Ranges to be put on sights	
	5 per cent. error	10 per cent. error
Up to 1,100 yds. (inclusive)	Estimated range ...	Estimated range
Above 1,100 yds. and up to 1,500 yds. (inclusive)	Estimated range ...	2 Elevations required: From 50 yds. under to 50 yds. over estimated range
Above 1,500 yds. ...	2 Elevations required: From 50 yds. under to 50 yds. over estimated range	4 Elevations required: From 150 yds. under to 150 yds. over estimated range

If judging distance has to be resorted to the probable error will be large. As the magnitude of this error depends on the ability of the individual, no rule can be made which will apply generally.

#### 54. Searching

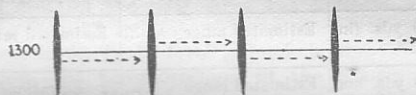
When it is desired to engage a target which has considerable depth and width (e.g., an area), it will usually be necessary to first open fire on the near end of the target and distribute the fire.

This procedure is repeated with successive elevations until the whole area has been engaged.

An alternative method is to use combined sights with a single point of aim and to traverse across the whole target with all the guns.

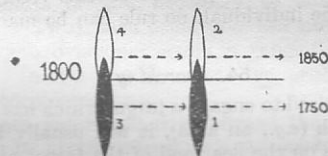
55. *Traversing and distribution*

1. Distribution of fire is the term given to the method of distributing the fire of a unit laterally on a target so that each gun engages an equal portion (see Figs. 21-24).



"ALL — 1300 — INDICATION — DISTRIBUTE

FIG. 21.



NOS 1 & 3 1750, NOS 2 & 4 1850  
INDICATION — BY SUBSECTIONS — DISTRIBUTE

\* RANGE BY RANGEFINDER.

FIG. 22.

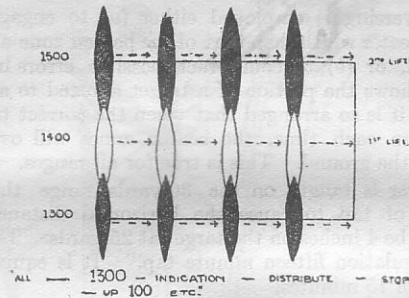
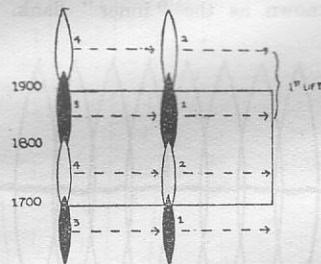


FIG. 23.



"NOS 1 & 3 1650 — NOS 2 & 4 1750 —  
INDICATION — BY SUBSECTIONS — DISTRIBUTE —  
STOP — ALL — UP 200"

FIG. 24.



2. **Traversing** is employed either (a) to engage a target having greater width than that of the beaten zone at the range employed, or (b) to counteract possible errors in direction. Fig. 25 shows the portion of a target allotted to a particular gun, and it is so arranged that when the correct tap is given to the gun each time, the beaten zones will overlap each other on the ground. This is true for all ranges.

The firer is taught on the 30-yards range the required strength of tap to cause the horizontal distance between bursts to be 4 inches on the target at 25 yards. This is called the "regulation fifteen minute tap." It is equivalent to a traverse of 15 minutes.

3. When a section is ordered to engage a wide target, the usual method will be as follows:—

The two flanks of the target will be indicated, that named first being known as the "inner" flank, and the order

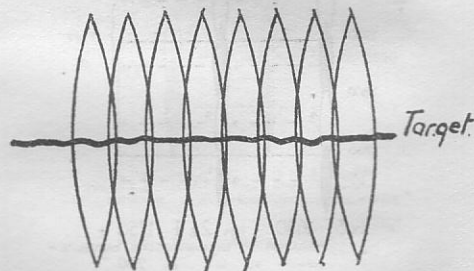


FIG. 25.

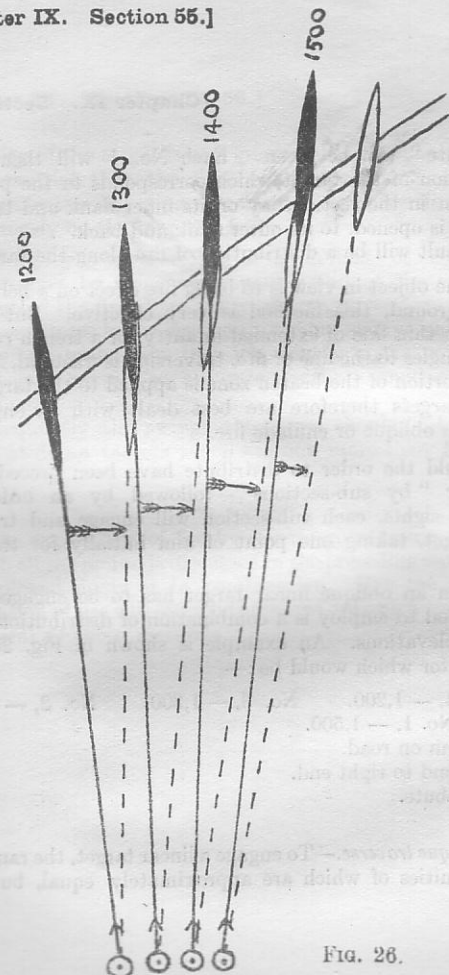


FIG. 26.

"distribute" will be given. Each No. 1 will then select that portion of the target which corresponds to the position of his gun in the section, lay on its inner flank and traverse when fire is opened, to its outer flank and back.

The result will be a distribution of fire along the target.

4. If the object in view is to bring fire effect on a belt or an area of ground, this method is very effective. But if the target is a thin line of extended infantry, or a trench running at right angles to the line of fire, traversing is wasteful, as only a small portion of the beaten zone is applied to the target.

Such targets therefore are best dealt with by engaging them with oblique or enfilade fire.

5. Should the order to distribute have been preceded by the order "by sub-sections"—followed by an order for combined sights, each sub-section will engage and traverse half a target, taking one point of aim initially for the two guns.

6. When an oblique linear target has to be engaged, the best method to employ is a combination of distribution with different elevations. An example is shown in Fig. 26, the fire order for which would be:—

No. 4, — 1,200.    No. 3, — 1,300.    No. 2, — 1,400.

No. 1, — 1,500.

Column on road.

Left end to right end.

Distribute.

Fire.

7. *Oblique traverse.*—To engage a linear target, the ranges of the extremities of which are approximately equal, but one

extremity of the target is at a greater altitude than the other, it is essential that the firer, while traversing, should so manipulate the elevating wheel as to keep his line of sight continuously on the target.

8. *Swinging traverse.*—This is a method of engaging a lateral target by firing continuously and at the same time distributing the fire along the whole target.

It necessitates loosening the traversing clamp, which allows the gun to vibrate more than in ordinary tap traversing, and it is, therefore, not so accurate as the normal method of traversing.

Consequently the swinging traverse should not be used, except at dense targets which are not more than 500 yards distant.

#### 56. Control

In the application of fire by several guns acting under one control, all the methods discussed in the preceding sections may be employed singly or in combination. But the successful application of fire will often be obtained only by a combination of several of those methods.

## CHAPTER X

## DIRECT AND INDIRECT FIRE

## 57. Introduction

1. Direct fire is the normal and most effective method of engaging a target and should, therefore, be employed whenever possible.

The advantages of direct laying over indirect laying are, that when the gun is layed, the correct angle of sight is automatically included.

The disadvantages are the personal error of the No. 1 in laying, the difficulties of pointing out and picking up targets, and those due to light, distance, dust, and bursting shells.

The problem of indicating and recognizing *difficult* targets can be minimised by using the direction and elevating dials on the guns in conjunction with the director.

The procedure would be as under :—

- i. Reference points are described.
- ii. When it is required to engage a target which is difficult to describe, the section commander will measure the angle subtended between the R.P. and the target, with graticules or director.

iii. Orders would then be issued as follows :—

Range (to target)—R.P.—Dials.

On this order being given sights would be adjusted for the range to the target, guns layed on the R.P. and dials zeroised.

iv If the target is right or left of the R.P., the order would be R. (or L).....degrees.

All guns are now deflected the requisite number of degrees ordered, using the direction dial.

Should the target not be on the same horizontal plane as the R.P., a further indication may now be given as "up" (or "down"),.....degrees, this being measured by graticules or angle of sight instrument. The lines of sight of the guns would thereupon be raised (or lowered) the requisite amount by using the elevating dials.

The actual point of aim would then be ordered, e.g., "Patch of brown grass."

If the target is vertically above or below the R.P., the order would be "up" (or "down").....degrees. The lines of sight would then be elevated or depressed the requisite amount by using the elevating dials.

2. Conditions which obstruct the field of view (e.g., bad visibility, smoke screens, the smoke and dust of artillery fire, &c.), may, however, often arise after fire has been opened. Consequently, when direct fire is employed, arrangements for indirect fire should be made if time permits, before fire is opened, and should be of the following nature :—

Once the guns have been layed on the target a gun aiming mark for each gun should be put out for the

purpose of maintaining elevation and direction. Clinometer readings should be taken and noted.

3. Cases will, however, frequently arise in which direct fire is impossible or inadvisable. The method then employed is that of indirect fire, *i.e.*, the direction of fire on to a target which is invisible to the firer. It is carried out by means other than that of laying the gun on the target over the sights.

The advantage of indirect laying over direct laying is that the necessity for pointing out the target to the number of individuals is removed and speed and accuracy thereby gained. In addition the laying is mechanical and its accuracy is not affected by light or distance. The disadvantage is the necessity for the measurement or calculation of the angle of sight and the consequent possibility of error.

4. Indirect fire therefore may be employed for any of the following reasons :—

- i. When no ground can be reached from which direct fire can be brought to bear on the target.
- ii. When to employ the number of guns necessary to give and maintain the requisite support, direct fire would be inadvisable owing to the great difficulty of obtaining the necessary concealment of the guns, chain of supply, &c., essential to enable them to continue in action under fire.
- iii. The fire of guns placed in rearward positions, to give depth to the defence, may be required for the support of troops in the forward area.
- iv. Supporting an attack at dawn or dusk.
- v. Darkness, mist or smoke.

5. The application of indirect fire with accuracy and rapidity entails a high standard of professional efficiency on the part of the officer. He must have a thorough knowledge of :—

- i. Maps.
- ii. The compass.
- iii. The tables and graphs which give—
  - (a) Tangent angles and angles of descent.
  - (b) Dimensions of cones and beaten zones.
  - (c) Methods of determining the angle of sight (*see* V.I. Graph, Appendix III).
  - (d) Method of determining the quadrant angle.
- iv. Methods of laying and fire control.
- v. The technical equipment in use.

6. It must be realised clearly that, except where accurate observation can be obtained, effective fire can seldom be obtained on a point target by means of indirect fire by merely laying all the guns employed on to that point.

The object must be to engage an area in which such a target is known to lie. The greater the care expended and accuracy obtained in the direction of fire, the smaller can be this area, and consequently the more effective the fire.

In such a case, it will usually be necessary to make use of searching and traverse to a limited extent.

Unless the officer controlling the fire has an accurate knowledge of his probable errors both in direction and elevation he may either :—

- i. By engaging an area unnecessarily large (in order to obtain fire effect on the target) obtain a very small material result ; or,



- ii. By engaging an area too small, miss the target altogether.

In practice a balance has to be struck between these two limits, according to the knowledge and judgment of the officer controlling the fire.

7. The principles and methods laid down in this chapter, apply to any number of machine guns that may be grouped together as a fire unit under the control of one officer.

The section—four guns—is referred to throughout for reasons of brevity and simplicity.

It must be realised that the figures in the following sections are not drawn to scale.

8. Although organized fire from a large number of machine guns can be carried out by controlling the fire of each gun separately, experience has shown that the method lacks flexibility, that calculations are laborious and control difficult. By the aid of simple calculations the organized fire of sections or larger units is made not only flexible but easy to control, and has proved of great value in supporting infantry in the attack.

#### 58. *Methods of application of indirect fire*

1. The methods of laying guns by indirect means consist of giving angles of direction to the guns which can be layed off from a point seen from the gun positions; and elevation from the horizontal plane which can be placed on the gun by means of the clinometer.

2. The methods of obtaining direction and elevation vary in different cases as under :—

**Case I.**—Guns layed on a target by direct means which may be required to fire during darkness, smoke or fog.

**Case II.**—When the target cannot be seen from the gun position but the necessary calculations can be made at an observing post from which both guns and target are visible.

**Case III.**—When an observing post cannot be used and direction has to be obtained by means of a map. For this a 1/20,000 (or larger) scale map is required.

#### 3. **Case I.**—*Direction and elevation.*

In Case I the guns having been layed “direct” it becomes necessary to maintain direction and elevation during darkness, fog or smoke.

**Method.**—The dial on the gun is zeroised and the tangent sight slide run up the stem until the line of sight is layed on an aiming mark about ten yards from the gun.

If it is required to fire at night the aiming lamp is placed out on the gun aiming mark.

In case it becomes impossible to see this during smoke or fog, the gun-detachment commander will note the Q.A. and adjust his clinometer accordingly, so that elevation can be checked.

Direction in this case can be maintained by keeping the pointer of the gun at zero on the dial.

#### 4. **Case II.**—*Direction.*

When giving direction to the guns from an observing post the method used will vary according to the position of the O.P. as under :—

- i. Where the director or a gun aiming mark is on the line of fire of one gun (methods (a) and (b)).
- ii. Where the director is not on the line of fire of one gun (methods (c), (d) and (e)).

The methods described below place all guns on parallel lines of fire with their direction dials at zero.

Under the heading of direction only, targets of the same width as the section frontage will be dealt with. For wider or smaller targets (see Secs. 59 and 60).

5. *Method (a).*—This is suitable when the guns can be brought into action close behind a crest and when a director is not available.

**Procedure.**—The section officer places two posts approximately between a flank gun and the corresponding flank of the target on which point he aligns the posts. The posts must be so placed that they can both be seen from the gun position. The tripod of the flank gun (called the directing gun) is then aligned on the two posts and the gun layed. The remaining guns are then placed on parallel lines to the directing gun in the following manner :—

- i. The dial of the directing gun is set at 180 degrees.
- ii. The directing gun and the gun to be zeroized then lay on each other.
- iii. The reading now given by the pointer of the traversing dial on the directing gun will be the angle through which the other gun must be swung to place it on to a parallel line.

**Example :—**(See Fig. 27).

No. 3 is the directing gun.

No. 2 is the gun to be zeroized.

No. 3 lays on its zero line 3C, and its traversing dial is set at 180 degrees.

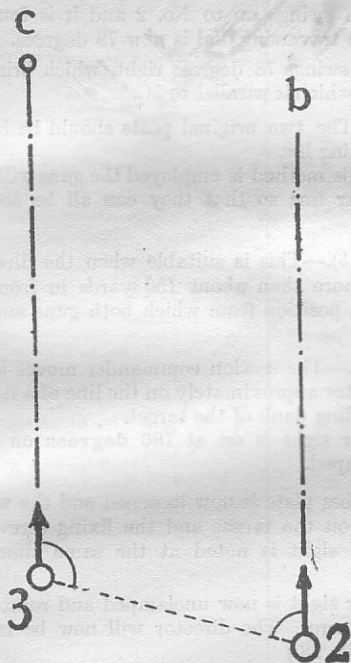


FIG. 27.

No. 2 lays on No. 3 and its dial set at zero.

No. 3 then swings on to No. 2 and it is found that the reading on its traversing dial is now 78 degrees.

No. 2 then swings 78 degrees right, which brings it on to the line 2B., which is parallel to 3C.

*Notes.*—1. The two original posts should be brought in to avoid their being hit.

2. When this method is employed the guns will be mounted in an irregular line so that they can all be seen from the directing gun.

6. *Method (b).*—This is suitable when the director can be erected not more than about 150 yards in front or behind the guns on a position from which both guns and target can be seen.

*Procedure.*—The section commander moves to a position with the director approximately on the line of a flank gun and the corresponding flank of the target.

The director sight is set at 180 degrees on the reading plate and clamped.

7. The reading plate is now loosened and the whole instrument aligned on the target and the fixing screw tightened. (The angle of sight is noted at the same time for future reference.)

The director sight is now unclamped and rotated until the pointer reads zero. The director will now be layed on the line OD (see Fig. 28.)

All guns will now be layed on the director, which will lay on each gun in turn. The angle read off the reading plate

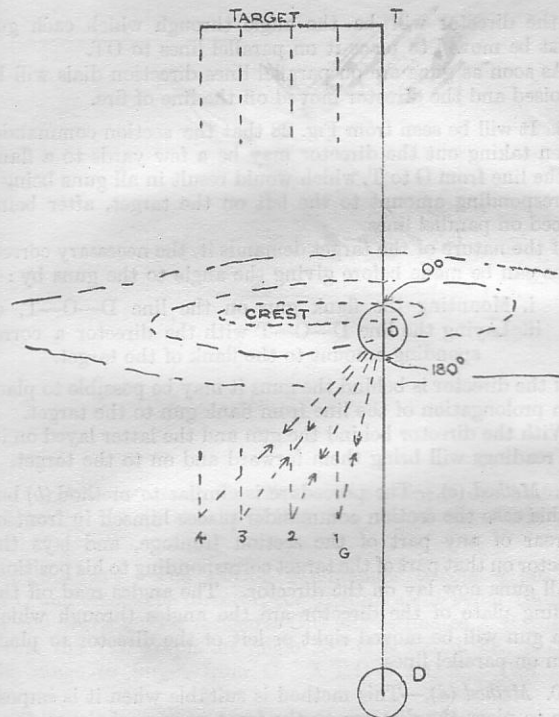


FIG. 28

of the director will be the angle through which each gun must be moved to place it on parallel lines to OT.

As soon as guns are on parallel lines direction dials will be zeroised and the director moved off the line of fire.

8. It will be seen from Fig. 28 that the section commander when taking out the director may be a few yards to a flank of the line from G to T, which would result in all guns being a corresponding amount to the left on the target, after being placed on parallel lines.

If the nature of the target demands it, the necessary corrections can be made before giving the angle to the guns by:—

- i. Mounting the flank gun on the line D—O—T, or
- ii. Laying the line D—O—T with the director a corresponding amount to the flank of the target.

If the director is behind the guns it may be possible to place it in prolongation of the line from flank gun to the target.

With the director behind the gun and the latter layed on it, the readings will bring them forward and on to the target.

9. *Method (c).*—The procedure is similar to method (b) but in this case the section commander places himself in front or in rear of any part of the section frontage, and lays the director on that part of the target corresponding to his position.

All guns now lay on the director. The angles read off the reading plate of the director are the angles through which each gun will be moved right or left of the director to place them on parallel lines.

10. *Method (d).*—This method is suitable when it is impossible to place the director to the front or rear of the section, but a position can be found within about 150 yards to a flank.

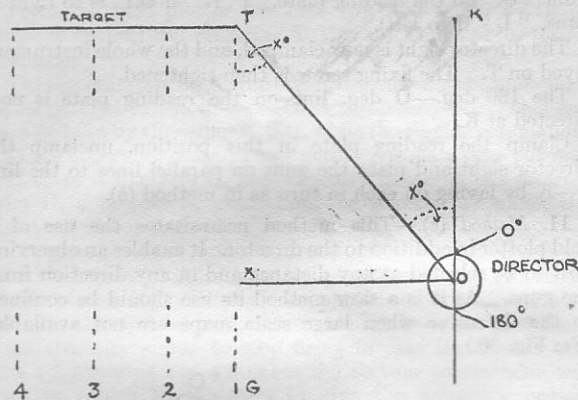


FIG. 29.

It will be seen from Fig. 29 that if a point K can be found where  $TK = XO$ , then GT (the line fire of the flank gun) will be parallel to OK.

*Procedure.*—The section commander selects a position at O and erects the director, the director sight being clamped at 180 degrees. He measures GO and estimates XO from it. From the V.I. graph the angle XTO is found, i.e., XO at the range to target from O.  $XTO = TOK$ . Call it X degrees.

The director sight is now unclamped and moved so that the "Red" pointer is deflected X degrees "R" or "L"



from "O" on the reading plate. ("R" if O.P. is to right of guns, "L" if to left).

The director sight is now clamped, and the whole instrument layed on T. The fixing screw is then tightened.

The 180 deg.—O deg. line on the reading plate is now directed at K.

Clamp the reading plate in this position, unclamp the director sight and place the guns on parallel lines to the line O—K by laying on each in turn as in method (b).

11. *Method (e).*—This method necessitates the use of a field plotter in addition to the director. It enables an observing post to be selected at any distance and in any direction from the guns. As it is a slow method its use should be confined to the defensive when large scale maps are not available. (See Fig. 30.)

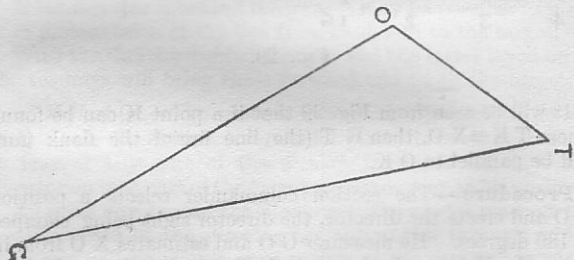


FIG. 30.

**Procedure.**—The observing post being selected, take ranges O—T and O—G and measure angle T—O—G, G being a flank gun and T the corresponding flank of the target.

From the field plotter (see Sec. 75), find angle T—G—O (angle of switch) and range G—T (this will be noted for future reference).

The directing gun G is layed on the director and the remainder layed parallel to the line G—O as in method (a). This can be carried out by the senior N.C.O. while the section commander is at the observing post. The "zero" posts are now put out.

If there is likely to be any difficulty in seeing the director from G, a prominent mark must be selected at which the director will be mounted.

All guns are now ordered to lay off the angle O—G—T from their parallel lines, thus bringing them on to the target (Angle of switch.) If there is telephonic communication with the guns this will be used, but care must be taken that there is an auxiliary signal to stop firing in case this line is cut. If a telephone is not available the section commander will have to return to the guns to give the necessary orders, though he may leave behind observers to semaphore observation of fire.

## 12. Means of maintaining direction.

*Methods (a), (b), (c), (d) and (e).*—As soon as guns are layed for direction the order "Out Target Posts," will be given. The numbers 3 directed by Nos. 1 will then put out target posts about 10 yards in front of the guns on their line of fire.

The gun-detachment commander is responsible that these are so placed that they will not be struck by the bullets from the guns.

## 59. Distribution of fire. (Case II.)

*Methods (a), (b), (d) and (e).*—1. When the frontage of the target on the line of fire EXCEEDS the frontage of the

section, it becomes necessary to open out the parallel lines of fire which have been shown hitherto, as otherwise only a portion of the target would be engaged. (Fig. 31.)

This process of "opening out" is called "distribution" and the angular difference between the lines of fire of any two adjacent guns after distribution is called the "angle of distribution." In Fig 31 the angle  $c3C$  is the angle of distribution.

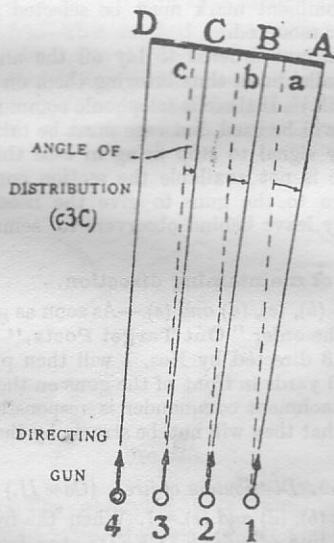


FIG 31

2. To obtain the angle of distribution it is necessary first to find the angle between the lines joining the flank guns of the section to the corresponding flanks of the target, i.e., the angle between the lines 1A and 4D (Fig. 31).

#### Procedure—

- (a) When, owing to the proximity of the O.P. to the gun position, it is evident that the angle subtended by the target at the O.P. is approximately equal to the angle subtended by the target at the gun position—
  - i. Find the angle subtended by the target at the O.P.
  - ii. From this angle subtract the angle subtended by the section frontage at the range to the target, which angle can be obtained from the V.L. graph.
  - iii. Divide the remainder by the number of gun intervals. The result is the angle of distribution.
- (b) When, owing to the distance between the O.P. and the gun position it is evident that the angle subtended by the target at the O.P. is considerably greater or less than the angle subtended by the target at the gun position—
  - i. With the field plotter solve two triangles, using each end of the target as the point T and with a common base O.G.
  - ii. Take the two angles T.G.O. thus found and subtract one from the other.
  - iii. From the resultant angle subtract the angle subtended by the section frontage at the range to the target.

iv. Divide the remainder by the number of gun intervals. The result is the angle of distribution.

3. The order "distribution" right or left  $X$  degrees is now given to each gun. The directing gun remains on its line, No. 3 gun swings through the angle of distribution away from the directing gun, No. 2 gun through twice the angle of distribution, and No. 1 gun through three times the angle of distribution.

This angle is now put on the deflection bar foresight (Sec. 71) by the gun-detachment commanders and the guns relayed for direction on the aiming mark.

4. In method (c) when the target is wider than the section frontage, this fact must be considered when laying in the first instance with the director.

A portion of the target frontage approximately equal to the section frontage should be selected, the distribution angle being computed accordingly.

#### 60. Concentration of fire. (Case II.)

*Methods (a), (b), (c), (d) and (e).*—1. When the frontage of the target on the line of fire is less than that of the section, it is necessary to concentrate the fire of the guns from their parallel lines of fire.

Fig. 32. (a) shows a section layed on parallel lines where the frontage of the target AB from the gun position is less than that of the section AC.

No. 4 gun is layed on the left end of the target.

Only a portion of the fire of the section can be applied to the target while the guns remain layed on parallel lines.

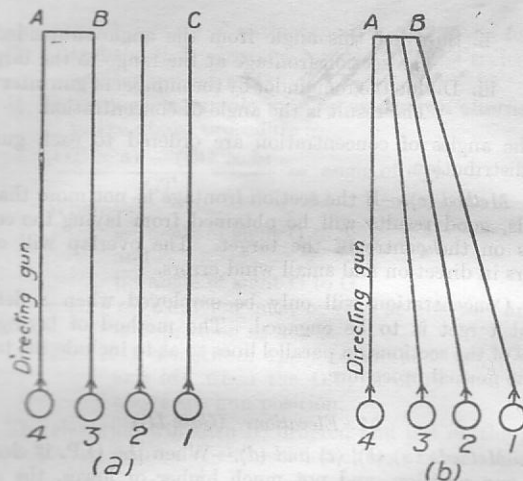


FIG. 32.

Fig. 32. (b) shows how the fire may be concentrated on to the target by closing in the lines of fire from the original parallel lines.

2. The following are methods of finding the angle of concentration:—

#### Procedure—

- i. In the same manner as described for distribution in Sec. 59, find the angle subtended by the target at the gun position.

- ii. Subtract this angle from the angle subtended by the section frontage at the range to the target.
- iii. Divide the remainder by the number of gun intervals. The result is the angle of concentration.

The angles of concentration are ordered to each gun as for distribution.

3. *Method (c).*—If the section frontage is not more than 60 yards, good results will be obtained from laying the centre guns on the centre of the target. The overlap will cover errors in direction and small wind errors.

4. Concentration will only be employed when a definite point target is to be engaged. The method of laying the guns of the sections on parallel lines so as to include the target is the normal procedure.

#### 61. Elevation. (Case II.)

1. *Methods (a), (b), (c) and (d).*—When the O.P. is close to the gun position, and not much higher or lower, the angle of sight from O.P. to target will be approximately the same as that from the gun position.

To obtain the Q.A., add or deduct the angle of sight as found at the O.P. to or from the T.A. for the range G.T.

2. *Method (e).*—Where the O.P. is a long way from the gun position the following means must be used to find the angle of sight from G to T:—

- i. Ranges O.T., O.G., and G.T. are known.

Take angles of sight O to T and O to G and by means of the V.I. graph (Appendix III) find the height of T and G with respect to O. From this

the height of T with respect to G can be found, and the Q.A. obtained by means of the trajectory graph (Appendix II).

- ii. The following formula may be used as an alternative to the above procedure:—

$$\frac{(OT \times a) - (OG \times b)}{GT} = \text{angle of sight G to T.}$$

Where—

a=angle of sight O to T

and

b=angle of sight O to G.

Angles of elevation must be read as plus and angles of depression as minus.

This may sometimes apply to methods (a), (b), (c) and (d), when the O.P. is more than 6 feet above the gun position.

3. The elevation will then be ordered and put on the guns in the following manner by the gun-detachment commanders—

Set the clinometer to the required reading.

Open the rear cover of the gun and fit the clinometer accurately on top of the side plates of the breech casing, the arrow head on the clinometer pointing towards the muzzle of the gun.

Elevate the gun by turning the elevating wheel until the bubble is central.

The required elevation will now be on the gun.

*Note.*—Before placing elevation on the gun the correction for atmospheric influences must first be made and the correction added to or subtracted from the Q.A. according as the correction is positive or negative. (See Appendix V.)



4. In indirect fire where the range is such that two or more elevations would be required to overcome errors in elevation or the target has depth, the area must be searched.

5. When elevation has been put on the gun the Nos. 1 will move the tangent sight slide until the line of sight is on the target post. This aim will be repeatedly checked during firing.

It is the duty of the gun-detachment commanders to ascertain that the bullets will clear the target posts. When the above has been carried out the order "load" will be given.

#### 62. Wind allowance and traversing. (Case II.)

1. *Methods (a), (b), (c), (d) and (e).*—The correct side wind allowance will be ascertained from the graph of climatic allowances and will be ordered as "WIND—RIGHT (OR LEFT) X DEGREES (OR MINUTES)."

The allowance will be made from the target post by means of the deflection bar foresight and it is not a deviation from zero lines (unless these happen to coincide with the lines of fire to the target).

2. *Methods (a), (b), (c), (d) and (e).*—It will be seen from Fig. 31 that when guns are layed on a target having any appreciable width, only 4 points are struck by the beaten zones. Therefore a traverse must be given to each gun so that the intervening spaces shall be swept by fire.

3. To determine the requisite traverse divide the angle subtended by the target in degrees by 6. This gives the amount each gun will traverse right and left, e.g., target subtends 3 degrees at the gun, 3 degrees = 30 minutes.

Order "ALL TRAVERSE RIGHT AND LEFT 30 MINUTES."

The machine gunner will be taught to recognize angles on the deflection bar foresight so as to limit his traverse to the required amount.

#### 63. Clearing the obstruction

1. In all cases where an obstruction exists between the gun and the target, it is necessary to ensure that the shots will clear the obstruction before opening fire.

To do this—

i. After the gun has been layed for direction and elevation adjust the tangent sight slide to read the range (plus 5 per cent. of the range to allow for possible error in range-taking) from the gun to the top of the obstruction. If on looking along the sights with the deflection bar foresight removed, the obstruction is not visible, the shots will clear.

*Note.*—If the line of sight only just clears the obstruction, the lower half of the cone will strike the obstruction.

ii. If the distance to the obstruction is under 100 yards put the sights at zero (the gun being already layed for direction and elevation); if, on looking along the sights the obstruction is not visible, the shots will clear.

2. If the obstruction is invisible (such as the summit of a hill hidden by a false crest) neither of the methods given above will apply, and the clearance must be found by the method given in Sec. 69, 13. The clearance must be at least equal to the height of the centre of the cone above the lowest shot. (See Range Table, Appendix I.)

## 64. Map-shooting. (Case III.)

1. Map-shooting is only possible when a map of a scale of 1/20,000 or larger is available. It is quicker than Case II, method (e) especially when overhead fire has to be considered. The great value of this type of indirect fire rests on the possibility of not only being able to engage a target without an O.P., but of engaging targets which cannot be seen from anywhere in our lines. Once guns have been placed on parallel zero lines, new targets can be engaged during the night. This advantage over other methods makes map-shooting eminently suitable for harassing fire.

## 2. Direction.

*Method (f). By map and compass.*—i. *The position of the gun on the ground must be accurately fixed on the map.*

This is done either—

- (a) By comparing the detail on the ground with the detail on the map; or, if this is not possible,
- (b) By resection.

Where time permits, greater accuracy is ensured by employing one method and checking with another.

It may be possible to obtain the aid of a survey unit where a very accurate location is necessary.

The use of oblique aeroplane photographs has been found helpful when moving guns forward to positions already sited on ground previously occupied by the enemy.

ii. *The magnetic bearing of the target from the gun must now be found.*

To do this—

- (a) Draw a line on the map from the gun position to the target.

- (b) Using the protractor, measure the bearing this line makes with a true north and south line. This is the true bearing of the target from the gun.
- (c) Add the magnetic variation of the compass from the north and south lines. The result is the magnetic bearing of the target from the gun.

*Notes.*—1. (c) Applies only to places where the magnetic variation is west.

If the variation is east, subtract instead of add.

2. The variation of the compass must be determined for each compass for the particular locality, and should be constantly checked.

iii. *To lay the directing gun on the magnetic bearing so obtained.*

Place a post (not more than 6 inches high) in the gun position and place the compass on the top of the post. Rotate the compass until the card reads the required bearing.

Align an aiming post on this bearing, using the hair line on the compass. Place the gun with the centre of the cross at the bottom of the socket immediately over the post, and lay on the aiming post. The remaining guns are then paralleled as in Case II, Method (a).

3. Method (g). *By map and reference point* (Fig. 33).

i. The position of a flank gun on the ground must first be accurately fixed on the map.

ii. A reference point, which is both marked on the map, and visible from the directing gun, is next selected. A line is drawn on the map—

- (a) From the gun position to corresponding flank of the target—G.T.; and
- (b) From the gun position to the R.P.—GR.

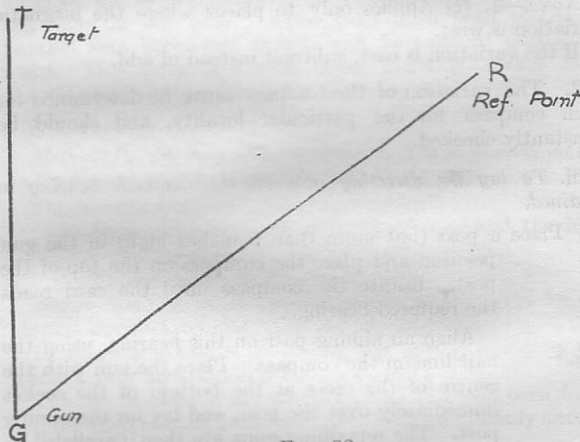


FIG. 33.

The angle TGR is now measured with a protractor. The directing gun lays on the R.P. and taps off the angle TGR, and an aiming post is put out in the direction obtained. The gun is now aligned on the target.

The remaining guns are paralleled as Case, II Method (a).

4. Direction will be maintained as in the methods previously described.

5. **Distribution.**—The procedure to be followed in calculating the amount of distribution to order is arrived at as follows (see Fig. 31). Draw 1a parallel to 4D, then angle Ala equals angle between 1A and 4D.

Measure angle Ala with a protractor.

Divide this angle by the number of gun intervals; the result is the angle of distribution.

6. It will be seen that the angle a1A is three times the angle of distribution c3C, and that the angle b2B is twice the angle of distribution c3C.

It follows, therefore, that in this particular case of a section when distribution is ordered, the directing gun remains on its line; No. 3 gun swings through the angle of distribution, away from the directing gun; No. 2 gun through *twice* the angle of distribution and No. 1 gun through *three* times the angle of distribution.

7. **Concentration.**—When the target is less than the frontage occupied by the section and it is desired to concentrate the fire; the procedure to be followed will be similar to that for distribution described above, but the angle obtained will be that for concentration instead of distribution.

8. **Elevation.**—On the map measure range from guns to target and note:—

- (a) Gun contour,
- (b) Target contour.

The Q.A. is now found from the trajectory graph. (Appendix II.)

9. The means of maintaining elevation, the methods of allowing for wind and traversing are the same as laid down for previous methods.

### 65. Angle of deviation from zero

1. This is found by combining the angle of switch with the angle of distribution or the angle of concentration, or the necessary multiple thereof. It will be noticed that the angle of deviation from zero of the directing gun equals the angle of switch.

2. When shooting by the map the angle of deviation from zero for each gun is entered on the fire control chart.

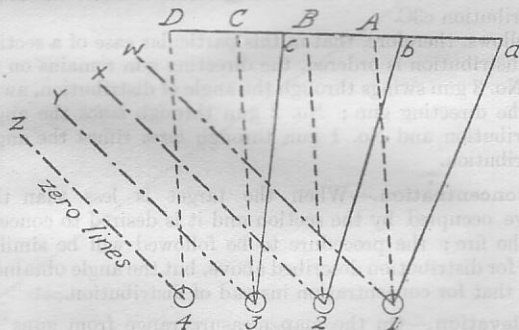


FIG. 34.

Angle Z4D = Angle of switch.

" C3c =	"	distribution.
" c3Y =	"	deviation from zero No. 3 gun.
" b2X =	"	" " No. 2 gun.
" a1W =	"	" " No. 1 gun.

*Example.*—A section in position: the angle of switch for a certain target is 55 deg. right: the angle of distribution is 30 min. What is the angle of deviation from zero for No. 1 gun (No. 4 gun directing)?

No. 1 gun will swing to the right first through the angle of switch = 55 deg., and then (still in the same direction) through three times the angle of distribution =  $3 \times \frac{1}{2}$  deg. =  $1\frac{1}{2}$  deg.: the angle of deviation from zero is therefore  $56\frac{1}{2}$  deg. R. for this particular gun and target.

Note that if the switch had been 55 deg. *left*, the angle of deviation from zero would have been  $53\frac{1}{2}$  deg. L.

### 66. Notes on elevation

1. Cases such as that shown in Fig. 35 will often arise. It is obvious that a different Q.A. must be placed on each gun in order that the target may be engaged.

The procedure should then be as follows:—

- Determine the Q.As. for the flank guns.
- Find the difference between these Q.As.
- Divide the difference by the number of gun intervals.

Thus: supposing that in Fig. 35—

Q.A. for No. 1 gun = 4 deg.

Q.A. for No. 4 gun = 5 deg.

Difference = 1 deg.

Dividing by 3 gives 20'.

Then Q.A. for No. 2 gun =  $4^{\circ} 20'$ .

" " " 3 " =  $4^{\circ} 40'$ .

Give out the elevation as determined above to each gun. Searching will be employed when the nature of the target demands it.



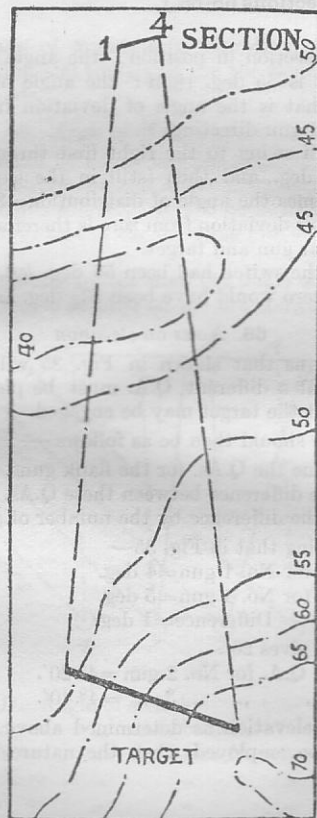


FIG. 35.

### 67. Organization, direction and control of indirect fire

1. Frequently in position warfare, and on occasions in mobile warfare, it will be necessary to undertake operations of a deliberate nature. In such circumstances, indirect fire by machine guns must be so organized, directed and controlled as to admit of a high degree of flexibility, in order that new targets presenting themselves may be engaged with rapidity and accuracy.

This necessitates careful :—

Organization : Laying : Fire control.

2. *Organization.*—i. The guns to be used will be placed under the orders of the brigade machine-gun officer, who will organize the fire action in accordance with the brigade commander's instructions.

ii. The *brigade machine-gun officer* issues orders dealing with the tasks allotted to each of his squadrons or platoons. These orders are contained on the fire direction chart. (See Appendix VII.)

iii. The *platoon commander* is responsible for the clearance of the fire of his guns over any troops on the line of fire, also for allotting tasks to his two sections, for which he will use the fire direction chart. (See Appendix VII.) He is responsible for the control and supervision of the fire of his platoon and for estimating the amount of ammunition and supplies required.

The *section commander* issues definite instructions to each gun-detachment commander on the fire control chart. (See Appendix VIII.)

In order to facilitate control, he should prepare a fighting map on the fighting map tracing. (See Appendix IX.)

iv. *The gun-detachment commander* will control the fire of his gun in accordance with the instructions on the fire control chart, or as ordered by the section commander.

He is responsible for ensuring that the correct direction and elevation are placed and maintained on his gun.

3. *Fire control.*—The fire of the troop or section will normally be controlled by its commander in direct communication with all his guns. He will act under the instructions of his squadron or platoon commander, who will establish communication with him.

Observation of fire must always be sought either from the vicinity of the guns or by a forward observing officer in communication with the squadron or platoon commander by visual signals or orderly.

Strict fire control by gun-detachment commanders is necessary to prevent undue expenditure of ammunition.

4. *Target frontage for each gun.*—When the fire of a squadron or platoon is distributed over a linear target the frontage allotted to any gun should not exceed 50 yards.

### 68. Night firing

#### 1. Two cases will usually occur:—

- i. *Gun brought into position and layed by day.*—The simplest method of night firing is when the gun can be brought into position and layed on the target by day, the aiming lamp being put out on the target post at a suitable distance from the crosshead in

line with the target. After dark the sights should be aligned on the lamp without altering the direction or elevation of the gun.

If the target is not visible, indirect means must be employed to lay the gun.

- ii. *Gun brought into position for the first time by night.*—In this case the problem is one of ordinary indirect fire, and two alternatives will arise:—

- (a) If the gun position can be fixed by day, it should be marked by a small post. A second post must be put out in alignment with the target if visible, or by compass if invisible, a convenient distance from the first post (which marks the position of the crosshead).

By night the tripod must be mounted accurately over the small post and the aiming lamp placed in the same position as the second post. The gun can then be layed for direction. Elevation having been put on with the clinometer, the firer should raise his tangent sight slide until the sights are aligned on the lamp. He can thus maintain both direction and elevation.

- (b) If it is not possible to get by day to the position on which the gun is to be mounted at night, the following procedure should be adopted—

Obtain from the map the magnetic bearing of the target from the gun position, and the necessary angle of quadrant elevation.

On arrival at the gun position, direction should be put on by compass and elevation by means of the clinometer.

The night aiming lamp should then be put out, and the firer should adjust his tangent sight slide until the sights are aligned on the lamp. Careful instruction must be given in the use of the night sights.

2. The above methods can be adapted to the relief during darkness of a gun layed on a definite target by another gun to be layed on the same target.

In all cases it is advisable to employ a small amount of traversing and searching in order to make certain of including the target.

3. An electric torch is essential for reading graduations on the direction dial and tangent sight, and for setting and reading the clinometer.

4. When firing is carried out from positions some way behind the front line, particularly when the latter is reached by overland routes, special precautions (such as posting sentries or wiring the danger area) must be taken to prevent endangering our own troops when passing near the gun position.

The safety of working parties and patrols in front of the forward positions must be ensured by liaison.

## CHAPTER XI

### OVERHEAD AND FLANKING FIRE

#### 69. Overhead fire

##### Introduction and rules.

1. Since, both in attack and defence, machine guns must be disposed in depth, the amount of support which they can afford to the forward troops must in great measure depend on the practicability of overhead fire.

2. In order that the safety of the troops fired over may be ensured, it is essential that their movements or position should be observed by or known to the officer controlling the fire of the machine guns in question.

3. In the defence this should not present any serious difficulty. In the attack, however, the possibility of observing the movements of our own troops will depend on various factors, e.g., the nature of the ground (whether open or close, flat or hilly), the presence or absence of obstructions to the field of view, such as bad visibility, smoke screens, &c. Since some or all of these factors may often be adverse, it is evident that, unless there is a time-table in force for the operation in hand, definite limitations are imposed on, and

considerable caution must be exercised in, the use of overhead fire by machine guns in supporting the attack.

4. Apart from the above considerations, the machine gun, by reason of its stable mounting and the close grouping of its fire, is well fitted to carry out overhead fire with safety to our own troops, for which type of fire action the following methods will be employed.

#### 5. Rules for overhead fire.

- i. Ranges to our own troops must be known to within 5 per cent.
- ii. Fire must not be delivered over the heads of our own troops when the range to those troops exceeds 2,000 yards.
- iii. It must be ensured that the bullets shall pass at a certain minimum height above the heads of the troops fired over.
- iv. Barrels and tripods must be in good order.

#### 6. The ground and the trajectory.

The curve of the trajectory for the centre shot of a cone of fire at every range is known and is illustrated in the trajectory graph (see Appendix II).

Similarly the minimum height at which the centre shot of a cone of fire should clear troops at varying distances from the guns has been determined and is stated below the trajectory graph.

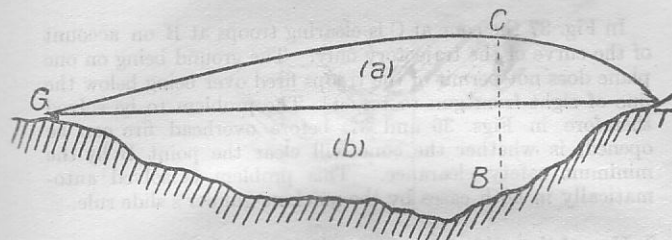


FIG. 36.

G. Gun position.  
T. Target.

B. Troops fired over.  
GT. Line of sight.

In Fig. 36 the cone at C is clearing troops at B owing to two distinct factors :—

- i. The natural curve of the trajectory above its line of sight.
- ii. The fact that the troops at B are below the line of sight.

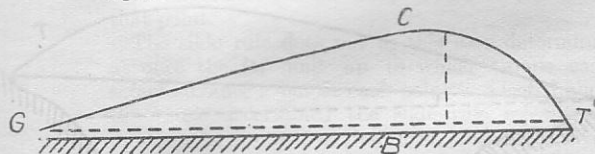


FIG. 37.

G. Gun position.  
T. Target.

B. Troops fired over.  
GT. Line of sight.



In Fig. 37 the cone at C is clearing troops at B on account of the curve of the trajectory only. The ground being on one plane does not permit of the troops fired over being below the line of sight from gun to target. The problem to be solved therefore in Figs. 36 and 37, before overhead fire can be opened, is whether the cone will clear the point B by the minimum safety clearance. This problem is solved automatically in both cases by the machine-gunner's slide rule.

#### 7. Use of the slide rule.

- i. The officer controlling the guns at G estimates the approximate point up to which he thinks troops advancing will be safe. He will indicate this point to his range-taker and order him to take the range to it. Let the range in this case be 1,300 yards and the range to target 1,600 yards—Fig. 38. He then adjusts the slide rule so that 1,300 yards on the slide comes opposite the point marked 1,600 yards on "range to target" column.

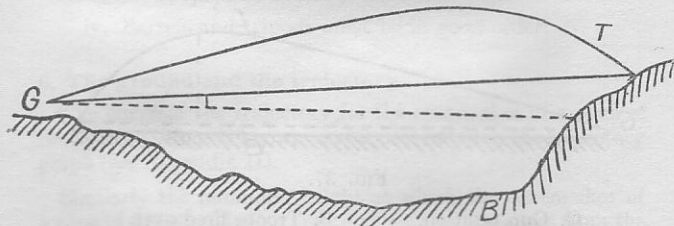


FIG. 38.

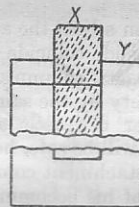


FIG. 39.

This will cause the slide to project above the top of the rule (Fig. 39).

- ii. Procedure :—(a) Hold the rule vertically at the full length of the string, i.e., 24 inches from the eye, bringing the top of the projecting slide (X) in line with the target. (b) Note where the top of the rule itself (Y) cuts the ground.

If it cuts the ground beyond B as in Fig. 38, troops at B will be safe.

If it cuts below B the troops would be unsafe at that point.

The slide rule does not in this case determine at once the far limit up to which troops can safely advance; but as each point is selected and the range ascertained the slide rule rejects or approves it in turn as described, and the above procedure must be repeated until the far limit is found by a process of elimination.

E.g., in Fig. 38, B at 1,300 yards is found to be safe. The officer would then order the range-taker to find and indicate to him a point at 1,400 yards.

He would then adjust the slide rule to make 1,400 yards on the slide coincide with 1,600 yards on the "range to target" column and test this 1,400 yards point for safety by the same process.

iii. When the officer has ascertained the far limit at which troops will be safe, he will indicate it clearly to the gun-detachment commanders in order that, in the event of his becoming a casualty, covering fire shall not break down.

iv. In the case shown in Fig. 37 the procedure for determining safety is slightly different. In this case:—

(a) Take the range to the target (see Fig. 37, 1,600 yards) and set the slide to zero, *i.e.*, with no part of it projecting.

(b) Read whatever figure on the slide coincides with 1,600 yards on the "range to target" column. (This figure will be seen to be 1,150 yards.)

(c) Order the range-taker to find and indicate a point 1,150 yards from the guns and indicate this point to the gun-detachment commanders as before.

v. When the troops have reached the far limit so that fire can no longer be maintained on the target without infringing the minimum clearance, fire may be lifted on to suitable targets in rear.

In cases in which the troops to be fired over are close in front of the guns, it will also be necessary to ascertain the "near limit"—*i.e.*, how far they must be from the guns in order that the cone may pass at a sufficient height above their heads. The minimum clearance at 600 yards and all ranges under is laid down as 11 yards. This is ensured

by the application of the graticules on the slide rule marked 5, 4, 3, 2, 1, in the same manner as for the far limit.

*Example:—*

*Case 1.*—Troops are on the line of sight.

Range to target ... 1,900 yards.

Near limit ... 200 " (approx.).

Far limit ... 1,500 "

*Case 2.*

Range to target ... 1,900 yards.

Near limit ... Troops at 100 yards from the guns must be  $2^{\circ} 30'$  below the line of sight.

Far limit ... Varying with the ground.

*Note.*—If combined sights or searching is used, the lowest range must be taken as "range to target."

### 8. The safety angle.

i. The necessary clearance above the heads of the troops fired over can be expressed as a height, *i.e.*, in yards or metres

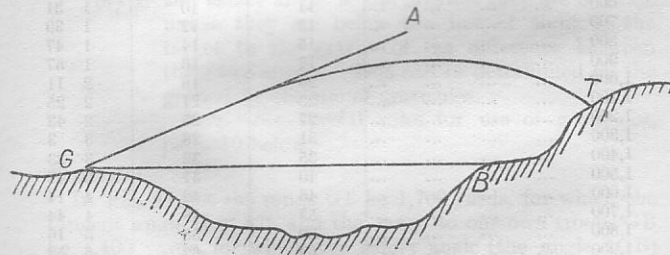


FIG. 40.

or as an angle known as a "safety angle," which is measured from the axis of the barrel.

In Fig. 40, G is a gun layed to engage the target T, and GA is the axis of the barrel. Then if the angle AGB is the safety angle required for the range GB, it is safe to fire at T until our troops reach B. The following table gives the minimum clearance and the equivalent safety angle for all distances to our own troops :—

Range to our own troops Yards	Minimum Clearance from centre shot		Safety Angle
	Yards	Metres	
100	11	10	6 21
200	11	10	3 16
300	11	10	2 17
400	11	10	1 51
500	11	10	1 38
600	11	10	1 31
700	13	12	1 39
800	15	14	1 47
900	17	16	1 57
1,000	20	18	2 11
1,100	23	21	2 25
1,200	27	25	2 43
1,300	31	28	3 3
1,400	35	32	3 23
1,500	40	37	3 47
1,600	46	42	4 14
1,700	53	48	4 44
1,800	60	55	5 16
1,900	69	63	5 52
2,000	80	73	6 34

ii. The clearance at any point over which fire is being directed is the vertical distance of the centre shot of the cone above that point. In the calculation of the above clearances adequate allowance has been made for probable errors in range-taking (up to 5 per cent.), estimation of climatic allowances, sighting of guns, and clinometer adjustment, or due to possible movement of the tripod. Allowance has also been made for the distance of the lowest shot of the cone below the centre shot.

iii. The method of application will be as follows :—

- Obtain the ranges to the target and to our own troops.
- Compare the safety angle for the range to our own troops (*see table*) with the tangent angle for the range to the target.

*Note.*—If combined sights or searching is used, the tangent angle for the lowest range must be employed.

- If the safety angle is the smaller, the troops are safe at that range.
- If the safety angle is the greater, they are not safe unless they are below the line of sight to the target to the extent of the difference between these two angles. This can be determined on the ground by the use of graticules.

*Note.*—*See* special rules for use of graticules, para. 10 below.

*Example :—*

In Fig. 41, let the range GT be 1,700 yards, for which the tangent angle is  $2^{\circ} 57'$ , and the range to our own troops GB be 1,400 yards, for which the safety angle (the angle AGB) is  $3^{\circ} 23'$ .

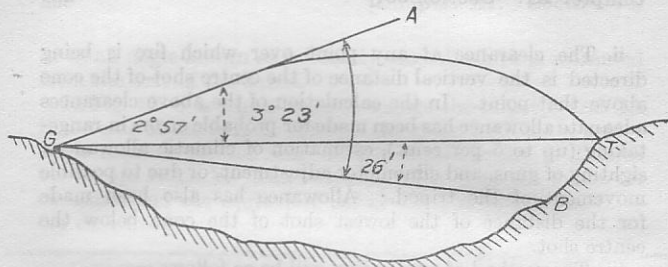


Fig. 41.

Then the safety angle is greater than the tangent angle by 26' (this is the angle TGB), and our own troops will not be safe unless they are 26' below the line GB. This can be ascertained by the use of graticules.

iv. The calculation of the safety angle given above is as follows :—

In Fig. 42 our own troops are at a range GB, at which range it is necessary that the cone of fire shall pass at the height BC above their heads.

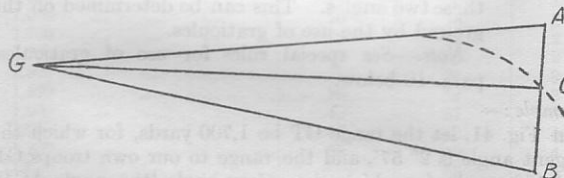


Fig. 42.

To cause the cone of fire to pass through the point C, the axis of the barrel must be directed towards the point A, the angle AGC being the tangent angle for the range GC (or GB)..

Thus the whole angle AGB is the safety angle for the range GB. This calculation has been made for all distances to our own troops and the necessary safety angles obtained.

#### 9. The observing post.

It is of vital importance that guns delivering overhead fire should be under the immediate and effective control of the fire-unit commander. The selection of a suitable observing post will therefore form part of the reconnaissance for any section position.

The observing post should be, if possible, within 50 yards from the nearest gun. In practice the only satisfactory way of controlling guns is by word of mouth, with the help of the signals described in Sec. 11. Other methods will tend to produce either loss of time, loss of flexibility, or loss of control.

#### 10. Rules for use of graticules.

The safety of our own troops can be ensured by the use of graticules, provided that the guns can be sited in such a position that an observing post can be selected close to the gun position and not more than 6 feet above any gun from which :—

- i. Both the target and the gun position can be seen.
- ii. The movements of our own troops on the line of fire can be observed.



- iii. The distance (from the observing post) to the target and the distance from the gun position to the target are approximately equal.

*Note.*—Graticules include slide rule, graticuled glasses, or any other form of angular measurement used in direct overhead fire.

### 11. Height of O.P. in relation to guns.

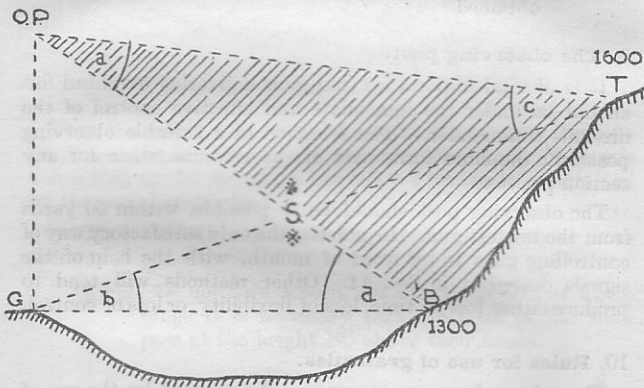


FIG. 43.

In the triangles OST and GSB, the two angles \* are common

$$\therefore a + c = b + d$$

$$\therefore a = b + d - c$$

let the height of OP above guns be 10'.

Then by V.I. scale  $c = 21'$ ,  $d = 26'$  and  $b = 28'$ , being the difference between the safety angle for 1300' and the T.A. for 1600'.

$$\therefore a = 28' + 26' - 21' = 33'$$

set the arrow scale to 33'.

If an observing post cannot be selected which is not more than 6 feet above any gun, the graticules determined by the slide rule and the safety angle method at the O.P. become inaccurate for the guns and will have to be modified.

This in practice presents such a complication that every effort must be made to avoid it by the careful siting of guns and O.P. in relation to each other.

When this is unavoidable, the following will be the procedure:—

If using the slide rule:—

- i. Subtract the angle subtended by the difference in height between O.P. and guns at the range to target, from the angle subtended by the difference in height between O.P. and guns at the range to troops.
- ii. Add the difference between these two angles to the graticule obtained by putting range to our own troops against "range to target." For this the scale on the right edge of slide rule can be used. Now use the slide rule in the normal way (see Sec. 76, vi, Note 1).

### 12. Safety angle method.

Add the angle obtained in para. 11 i above to the safety angle for range to our own troops. The result will be the modified safety angle to be used. Fig. 43 shows the procedure in diagram.

### 13. Calculation of clearances.

When the guns cannot be sited in such a position as will admit of the selection of an observing post fulfilling the

necessary conditions, overhead fire can only be delivered with safety to our own troops provided that:—

- i. If the troops are in movement, a time-table is in force, *or*;
- ii. The troops are stationary and their position is accurately known.

Subject to the above conditions, the safety of our own troops can be ensured by calculating clearance obtained and comparing this with the minimum clearance required at the range to troops fired over.

14. Before the clearance in any particular case can be ascertained, it is necessary to determine the relative heights of the gun position, our own troops and the target.

15. In order to find the clearance, *i.e.*, the height from the ground to the centre of the cone at any point in the line of fire, the trajectory graph (Appendix II) should be used.

16. *Example of use.*

i. To find the quadrant angle—Suppose the gun to be on a 105 metre contour, and the target to be on a 120 metre contour (*i.e.*, 15 metres above the gun) at a range of 2,500 yards.

Take the 2,500 range and follow up the vertical line to a point 15 metres above the gun level. It will be found that the 7 deg. 50 min. curve cuts this point. This will be the correct quadrant angle to put on the gun.

ii. To find the clearance over our own troops—Suppose that our own troops are on the 190 metre contour (*i.e.*, 85 metres above the gun) at a range of 1,000 yards.

Take the range 1,000 yards, and follow up the vertical line to the point 85 metres above the gun. Measure upwards from

this point to the point where the 7 deg. 50 min. curve cuts the 1,000 yards range vertical line. This will be seen to be 23 metres above the position of the troops. At the foot of the diagram it will be noted that 18 metres clearance is necessary at this range. The clearance is, therefore, sufficient.

If it is desired to find the clearance of the lowest shot, subtract the figure at the top of the diagram. (Use the “metres” or “yards” figures according to the unit in which the calculation is being worked out.) In this example the clearance of the lowest shot will be 23—3 metres, *i.e.*, 20 metres.

iii. To find the clearance above an obstacle.—Suppose there is a hill crest at a range of 1,600 yards at a height of 239 metres (*i.e.*, 134 metres above the gun). Find this point on the scale as before. It will be noticed that the curve exactly cuts it. The upper half of the cone will therefore clear the hill, but the lower half will hit it. In order that the whole of the cone may clear the obstruction, the clearance must be not less than half the height of the cone at the distance from gun to top of the obstruction (*see* Column 4, Range Table, Appendix I).

*Notes.*—The yard scales can be used in place of the metre scales in the case of maps contoured in yards, or where it is required to find the clearance in yards.

It will be found more easy to read the graph if a pin is stuck into the position of the target and that of the troops or obstruction when found.

The range corresponding to any given quadrant angle can be found by following the QA curve until it cuts the zero line, *e.g.*, range 2,500, target 15 metres above the gun, QA, is 7 deg. 50 min.; follow this curve along; it cuts the zero line at a range of 2,550 yards, which is the range corresponding to this angle.

## 70. Flanking fire

1. When fire is carried out directly to a flank of our own troops the following precautions must invariably be taken:—

- i. The limit of the line of fire GB (Fig. 44) must not be closer than 3 deg. to the line joining the gun and the flank of our own troops GA.
- ii. This type of fire must not be attempted if the exact position of our own troops is unknown.
- iii. Steps must be taken to prevent traversing beyond the line GB.
- iv. Careful allowance must be made for side winds.
- v. If our own troops are advancing, the line GA (Fig. 44) must be such that, if produced, it does not meet our own troops within 3,000 yards from the gun. Further the exact rate of advance must be definitely fixed.

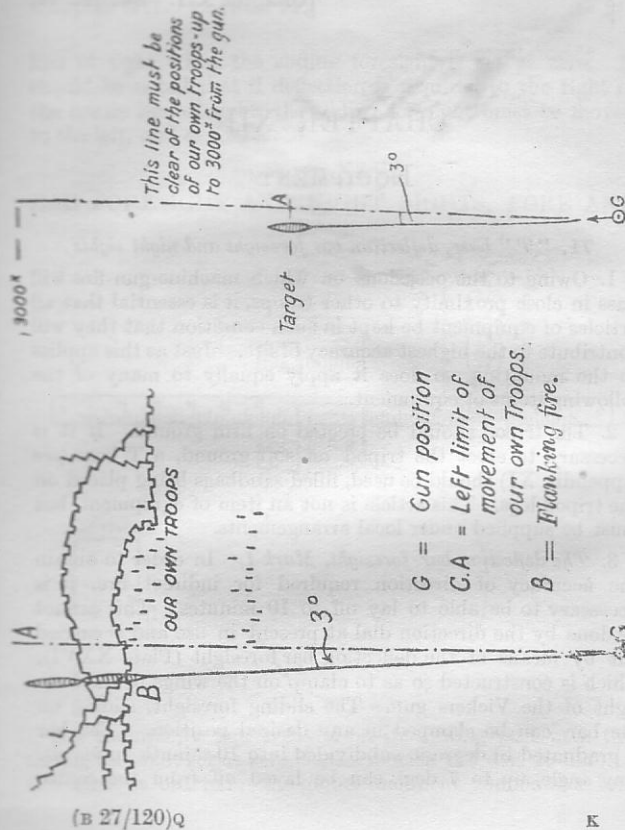


Fig. 44.

## CHAPTER XII

## EQUIPMENT

## 71. "T" base, deflection bar foresight and night sights

1. Owing to the occasions on which machine-gun fire will pass in close proximity to other troops, it is essential that all articles of equipment be kept in such condition that they will contribute to the highest accuracy of fire. Just as this applies to the mounting, so does it apply equally to many of the following items of equipment.

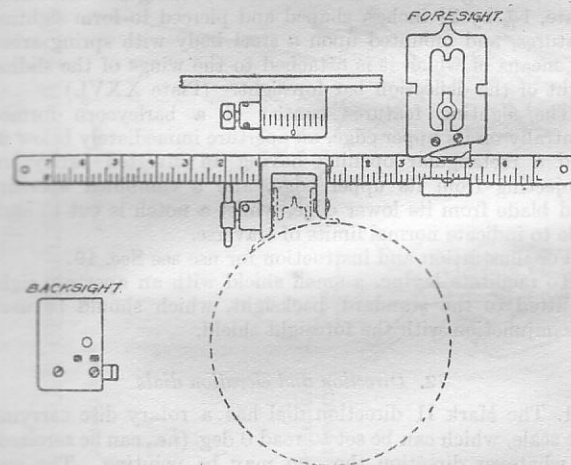
2. The tripod should be erected on firm ground. If it is necessary to erect the tripod on soft ground, a T base (see Appendix XI) should be used, filled sandbags being placed on the tripod legs. This article is not an item of equipment, but must be supplied under local arrangements.

3. *The deflection bar foresight, Mark I.* In order to obtain the accuracy of direction required for indirect fire, it is necessary to be able to lay off to 10 minutes. This cannot be done by the direction dial at present in use and is carried out by means of the deflection bar foresight (Plate XXVI), which is constructed so as to clamp on the wings of the foresight of the Vickers gun. The sliding foresight, sliding on the bar, can be clamped in any desired position. The bar is graduated in degrees, subdivided into 10-minute intervals. Any angle, up to 7 deg., can be layed off from the centre

line of sight when the sliding foresight is set at zero. It should be noted that if deflection is required to the right of the centre line of sight, the sliding foresight must be moved to the left, and *vice versa*.

## PLATE XXVI.

## BAR FORESIGHT AND NIGHT SIGHTS, FORE AND BACK.



For example, a gun is layed on its aiming post with the sliding foresight set at zero. Distribution of 1 deg. 20 min. to the right is ordered; the gun-detachment commander sets



the sliding foresight *to the left* along the bar until the index reads 1 deg. 20 min.; the firer then re-lays the gun on the aiming post. (Plate XXVII.)

4. *Night sights.*—For firing in the dark, night sights, back and front, are provided.

The backsight is the original No. 2 luminous backsight with shield, which may be used with or without luminous tubes.

The foresight consists of a vertical rectangular sheet steel plate,  $1\frac{7}{16}$  by  $2\frac{3}{8}$  inches, shaped and pierced to form sighting features, and mounted upon a steel body with spring arms, by means of which it is attached to the wings of the sliding sight of the deflection bar foresight. (Plate XXVI.)

The sighting features consist of a barleycorn formed centrally on its upper edge, an aperture immediately below it, and a rectangular opening having an inverted barleycorn projecting from its upper edge, and a combined aperture and blade from its lower edge, whilst a notch is cut in each side to indicate normal limits of traverse.

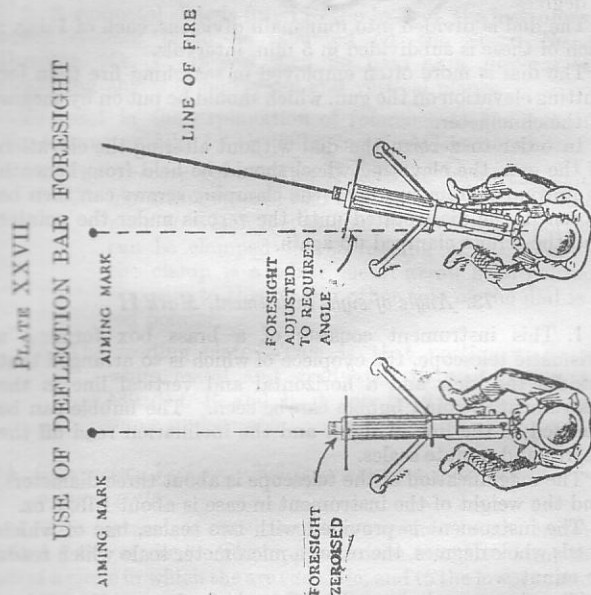
For illustration and instruction for use see Sec. 19.

To facilitate laying, a small shield with an aperture sight is fitted to the standard backsight, which should be used in conjunction with the foresight shield.

## 72. Direction and elevation dials

1. The Mark II direction dial has a rotary disc carrying the scale, which can be set to read 0 deg. (*i.e.*, can be zeroized) in whatever direction the gun may be pointing. The gun may then be swung right or left until the desired angle is read directly from the scale.

It is graduated from 0 deg. to 180 deg. on each side.



2. The elevation dial is fitted to the elevating wheel, one complete turn of which elevates or depresses the gun 4 degrees.

The dial is divided into four main divisions, each of 1 deg.; each of these is subdivided in 5 min. intervals.

The dial is more often employed in searching fire than for putting elevation on the gun, which should be put on by means of the clinometer.

In order to zeroize the dial without altering the elevation of the gun, the elevating wheel should be held from beneath to prevent it from turning; the clamping screws can then be loosened, the dial rotated until the zero is under the pointer and the screws clamped up again.

### 73. *Angle of sight instrument, Mark II*

1. This instrument consists of a brass box forming a prismatic telescope, the eyepiece of which is so arranged that besides the view and a horizontal and vertical line in the instrument, a spirit bubble can be seen. The bubble can be inclined to the line of sight, and the inclination read off the degree and minute scales.

The magnification of the telescope is about three diameters, and the weight of the instrument in case is about 1 lb. 8 oz.

The instrument is provided with two scales, one of which reads whole degrees, the other a micrometer scale which reads to minutes.

The degree scale is graduated in single degrees from 0 deg. to 15 deg. elevation and 10 deg. depression, the latter being filled in white on black.

The micrometer is graduated every 5 minutes, numbered

every 10 minutes in both directions, and coloured to agree with the degree scale.

2. A gunmetal slide is fitted to the base of the instrument, which enables it to be mounted on the Stand No. 4 Director, Mk. I. It can then be used as a director for measuring angles in horizontal and vertical planes.

To assist in the explanation of reference to the "Stand No. 4 Director, Mk. I" the following should be noted:—

- i. The director sight.—This is taken to mean the sighting arrangements and that portion of the instrument to which it is attached. This whole portion can be clamped to the reading plate. Close to the clamp is a white metal arrow head pointer, opposite to this on the other side of the dial is a red pointer.
- ii. The reading plate.—This is that portion made of white metal and graduated to read 0 deg. to 180 deg. R and L, it can be fixed by a fixing screw underneath.

### 74. *Clinometer, Vickers, .303-inch machine gun Mk. I, and aiming posts*

1. This instrument consists of a manganese bronze casting called "the cradle." The upper surface is cut to form the arc of a circle in which the arc can slide, and to the lower surface is attached a cast steel base adapted to rest between the side plates of the gun when the rear cover is raised.

A scale of degrees from 0 deg. to 20 deg. elevation and 20 deg. depression is engraved on one face and is read by an arrow

on the arc. The graduations for elevation and depression are filled in with black and are numbered every 5 deg. and followed by the letters "E" and "D" respectively.

2. A worm spindle is fitted in two bearings in the cradle, the rear end being on a pivot. This allows of the worm being put out of gear with the arc for quick setting, by pressing downwards on the front end of the worm spindle.

A spring is provided to keep the worm spindle and arc in gear.

Two micrometer collars are fixed to the worm spindle, the forward one for reading depression in minutes, the rear one for reading elevation in minutes.

The micrometer collars are divided every 5 min. and numbered every 10 min., and are coloured the same as the degree scale. The figures on the micrometer collars have the letters "E" and "D" engraved underneath to indicate elevation and depression respectively.

At the rear end of the worm spindle a milled head is firmly attached, and one turn of this milled head represents one degree.

3. The arc is shaped to slide in the cradle. On its under-surface are cut teeth, into which the worm gears. Attached to it by two screws is an adjustable reader for the degree scale. On its upper surface is attached a spirit bubble, the underside of which is rendered luminous for night work by means of radium paint.

The approximate weight of the clinometer and case is 3 lbs. 6 oz.

Engraved on the base is an arrow and the word "target." This is to indicate the correct direction in which to place the clinometer on the gun.

4. *Zero aiming post, M.G., Mark I.*—This is an iron stake 3 feet long and  $\frac{1}{2}$ -inch in diameter. The upper end is formed into a ring about 4 inches in diameter, the lower end being pointed to facilitate pressing into the ground.

The stake is painted uniformly drab and weighs 2 lbs. 10 oz.

5. *Target, aiming post, M.G., Mark I.*—This consists of a single telescopic stand capable of being raised or lowered between the limits of about 1 foot 10 inches and 3 feet from the ground.

The base of the stand is provided with a metal plate 4 inches in diameter, and 3 spikes 5 inches long.

The provision of the plate facilitates forcing the spikes into the ground by means of the foot, and at the same time prevents the stand from sinking in too far in soft ground and helps to maintain it in an upright position.

The tube is fitted with a clamping screw which allows the stand to be fixed at the required extension.

The inner rod is surmounted with a bracket to which the day aiming mark is permanently secured and to which the aiming lamp can be affixed.

To the inner rod is affixed a collar with clamping screw, which allows this rod to be maintained at a given height when rotated.

By this means the aiming lamp can be set at the same height as the day aiming mark if desired.

#### 75. *Plotter, field, Mark IV*

1. The field plotter is used for solving triangles mechanically. If the base, the range from one end of it to the target and the included angle are known, and the plotter is set to read them

on one side, the range from the other end of the base and the included angle can be read off on the other side of the plotter.

2. As the *Mark IV* pattern is designed primarily for use by the artillery, the ranges given on the range arms are greater than machine-gun ranges. It will therefore be necessary for the machine gunner to use some multiple of the ranges in the triangle to be solved. In most cases the most convenient multiple will be two.

3. *To use the plotter.*—The operations in using the instrument are as follows, and should be performed in the order given:—

- i. Slightly loosen all clamps.
- ii. Set the base to twice (or the necessary multiple of) the distance from the directing gun (G) to the observing post (O).
- iii. Move the double clamp along the upper range arm to twice (or the necessary multiple of) the distance from O to the target (T) and clamp the *upper* screw *only*.
- iv. Move the range arms until the arrow mark is opposite the angle TOG on the arc, and clamp the *lower* screw of the double clamp.
- v. Turn the instrument over, and on the range arm will be found twice (or the selected multiple of) the distance GT, and on the arc the angle TGO, which is called "the angle of switch."

*Example.*—

Suppose the base is 100 yards, the range OT is 1,500 yards, and the included angle TOG is 118 deg.

Set the base to 200 yards and the double clamp to 3,000 yards and the pointer to 118 deg.

Then on the reverse is read 3,100 yards and angle 59 deg., i.e., range GT=1,550 yards and angle of switch (TGO)=59 deg.

#### 76. *The machine-gunner's slide rule. (Mark I)*

The machine-gunner's slide rule provides a ready means of assisting the machine-gun officer in his fire control calculations. It has engraved on it the following:—

- (a) Range table.
- (b) V.I. scale.
- (c) Safety angle scale.
- (d) Wind scales.
- (e) Barometer and temperature scales.
- (f) Graticules.
- (g) 1/20,000 scale.
- (h)  $\frac{1}{2}$ -inch scale.
- (i) Degree scale similar to that on the service protractor.

i. *Range table.*—This gives the tangent angle, angle of descent, length and width of the beaten zone and width and total height of cones for all ranges.

ii. *V.I. scale.*—With a known V.I. and H.E., the angle subtended can be found by setting the length of H.E. on the sliding scale opposite the height of V.I. on the fixed scale. The angle can be read opposite the pointer. The V.I. or H.E. can be found in a similar manner when the remaining factors are known.

iii. *Safety angle scale.*—To use the scale, set the range to the troops to be fired over opposite the range to the target.

- (a) If the slide does not then project from the top end of the rule it will be safe to fire over the troops in question, provided the latter are not above the line of sight to the target.



- (b) If, on the other hand, the slide is found to project from the top end of the rule, hold the rule at the length of the string from the eye (24") and align the top of the slide on to the target.

Note the point where the top of the fixed portion cuts the ground. If this point lies beyond the troops in question, it will be safe to fire: but if short of those troops, it will be unsafe.

The size of the graticule safety angle thus applied can be read opposite the pointer on the degree scale.

iv. *Wind scale.*—Set the wind pointer opposite the range to the target and read on the scales on the reverse of the slide the allowance necessary for a wind (side or head, as the case may be) of 20 miles an hour. The allowance for rear winds may be taken as the same as for head, the allowance being subtracted from the elevation instead of added. In the case of oblique winds, the allowance will be halved.

v. *Barometer and temperature scales.*—Allowances for variations 1 inch of barometer or 20 degrees of temperature can be obtained from these scales on the reverse of the slide by setting the pointer (at the top of the slide) opposite the range.

vi. *Graticule card.*—The slide is marked with a degree scale at the top end, which can be used for graticule purposes when held at the length of the string from the eye.

*Note 1.*—Use of graticules to solve safety problems from an O.P. considerably above or below the guns, in either direct or indirect fire (TOG).

Graticules must not be used at more than 6 feet above or below the guns. When, however, the O.P. and guns are

approximately equidistant from the target (*i.e.*, there is not more than 50 yards difference in range), the amount by which the graticule safety angle from the gun position will have to be altered for use from the O.P. can be easily ascertained by means of the V.I. scale in the following manner:—

- (a) Find the difference in height between O.P. and gun position (in the usual way by means of the angle of sight).
- (b) By means of the V.I. scale find the angles subtended by this height at the ranges to target and to our own troops.
- (c) The difference between these two angles is the amount by which the graticule safety angle from the gun position will have to be altered, and will be added if the O.P. is above the guns and subtracted if below.

*Example.*—

Let the range to target be 2,000 yards.

The range to troops in question is 1,800 yards, and the O.P. is 22 yards above guns.

The graticule safety angle from guns will then be 1 degree (*see* safety scale).

22 yards at 1,800 subtends 41 minutes.

22 yards at 2,000 subtends 37 minutes.

Difference, 4 minutes.

Therefore graticule safety angle from O.P. is 1 degree 4 minutes, which can be applied by pushing up the slide another 5 minutes (approximately).

*Note 2.*—V.I. scale. It will be noted that the scale does not give angles of less than 30 minutes. Therefore when a problem involving an angle of less than 30 minutes is to be solved, some multiple of the angle will have to be used. A simple rule is as follows :—

When the angle in question is less than 30 minutes, use 10 times the V.I. and 10 times the angle with H.E. *unaltered*.

*Example.*—

V.I.—10 yards at H.E.—1,700 yards brings the angle pointer off the scale.

Take 10 times V.I.—100 yards at H.E.—1,700 yards.

The pointer will then give 10 times the angle, or in this case 200 minutes.

Therefore the angle required—20 minutes.

## PART III.—WAR

### CHAPTER XIII

#### CHARACTERISTICS OF THE MACHINE GUN

##### 77. *General characteristics*

1. The tactical handling of machine guns on the battlefield in co-operation with other sources of fire power, must be such that full value is obtained from the particular characteristics of these weapons.

2. *The outstanding characteristic* of the weapon is its power of delivering a concentrated volume of accurate and sustained fire, which, owing to the ease of control can be directed rapidly against any desired object, thereby facilitating surprise effect :—

i. Concentration and accuracy of fire are due to the tripod mounting, which gives the following results :—

(a) The fire is closely grouped so that its cone forms a regular beaten zone, which is very long in proportion to its width. When close grouping is not desired, fire can be distributed by traversing.

- (b) The personal factor is reduced. Fire over the heads of our own troops can be carried out with safety. Effective fire is possible at long ranges. Direction and elevation can be maintained both by day and night and indirect fire can be employed.
- ii. Sustained fire is rendered possible by the strong mechanism, belt feed and water-cooling system of the gun. Provided that arrangements are made for the renewal of the barrel, the supply of oil and water and the maintenance of the supply of ammunition, the fire of machine guns can, for all practical purposes, be maintained indefinitely.
3. *The location of the machine gun* may be detected by any of the following:—
- i. *Steam*.—After about 600 rounds of continuous fire the water in the barrel casing boils.
- ii. *Flash*.—The flash of the machine gun is discernible at night, in very dull weather, and against a dark background. This can be overcome by placing two screens one on each side of the gun and converging on the line of fire. A gap will be left to enable the aiming lamp to be seen.
- iii. *Muzzle blast*.—The discharge of the bullets and gases from the muzzle creates a blast which may raise considerable dust when the gun is fired from a low mounting. This can be prevented either by wetting the ground beneath the muzzle or by laying down wet sand-bags. The blast will also produce a fan-

- shaped mark, which is clearly visible from the air and requires concealment by artificial means.
- iv. *Noise of firing*.—The sound of a machine gun in action is unmistakable, but as the explosion at the gun is largely offset by the crack of the bullets in the air, the position of the gun cannot readily be detected.
4. *Comparative mobility*.—The mobility of the machine gun depends on its method of transport:—
- i. *When carried in the limbers*, the mobility of the machine gun on roads, tracks, or open ground is greater than that of the remainder of the infantry. When speed in getting into action is essential, three men of each gun detachment can be carried on the limbers.
- ii. *When carried on pack*, its mobility depends on the animal and the method employed to lead the animal. When the pack animal is led by a man on foot, the mobility is rather less than that of the remainder of the infantry; when the pack animal is led by a mounted man, the mobility is rather less than that of cavalry.
- iii. *When carried by the detachment* its mobility is considerably less than that of other infantry on account of the weight of the gun, ammunition and equipment.
5. The following are the chief points to be noted in comparing the above characteristics with those of the light automatic gun (Lewis or Hotchkiss guns). These weapons are cooled by air and are liable to become overheated after about 500

rounds of continuous fire. They are therefore less capable of sustained fire than the machine gun, and are the weapons particularly suited to engaging targets for which short bursts of fire are suitable. Lewis and Hotchkiss guns cannot be used for indirect fire, and it is seldom safe to use them for overhead fire.

The machine gun has a stronger mechanism and is less liable to stoppages than either the Lewis or the Hotchkiss gun. As it is fired from a stable mounting the machine gun is more accurate and can carry out indirect and overhead fire. Machine-gun loads are heavier than either Lewis or Hotchkiss gun loads; the latter can therefore be brought into action with greater speed.

## CHAPTER XIV

### GENERAL CONSIDERATIONS GOVERNING THE EMPLOYMENT OF MACHINE GUNS

#### 78. Introduction

1. The rôle of machine guns is to supply covering fire in the attack and defence and to economize man power. In order that they may carry out their tasks successfully their movements and dispositions must be governed mainly by their particular characteristics, due regard being given to the movements and dispositions of the troops they are covering or supporting. In the field, tactics and fire direction are interdependent. Both are based on the characteristics of the gun and are comprised in the term fire tactics.

2. The machine-gun squadron and platoon are integral parts of the cavalry regiment and battalion respectively, and regimental and battalion commanders must consider their employment in co-operation with the other weapons under their control.

3. Unit commanders should employ their machine-gun squadron or platoon commanders both in attack and defence :—

- i. To prepare for their approval the plan for the employment of the squadron or platoon.



- ii. To direct the tactical handling of the machine guns during battle in accordance with the unit commander's orders.
- iii. To keep unit commanders informed of the dispositions adopted and to ensure that close liaison is maintained with the units the machine guns are supporting and with the close support artillery.
- iv. To supervise the siting and construction of machine-gun emplacements.

4. The tactical situation may necessitate the brigade commander taking all or a portion of the machine guns belonging to the units under his command and placing them under brigade control. Such grouping should only be considered as temporary, and squadrons and platoons will revert to the immediate control of their respective regimental or battalion commanders as soon as the necessity for such grouping ceases.

The brigade control of machine guns does not imply the massing of machine guns or that all the machine guns of a brigade will necessarily operate under the immediate control of the brigade commander. It, however, enables the brigade commander to allot machine guns on a tactical basis, *i.e.*, according to the nature of the operation in hand and of the ground over which it is to take place. After the brigade commander has decided on the allotment of machine guns to suit his plan of action, some machine-gun platoons or sections can remain under the orders of the unit commanders whilst the remainder operate under brigade control. By this means the available machine-gun resources are disposed to the best advantage of the formation as a whole.

5. If, on the other hand, machine-gun squadrons or platoons are rigidly retained with their own units, irrespective of the tactical situation and considerations of ground, waste or loss of machine-gun fire may result. Situations will frequently arise necessitating the application or increase of machine-gun fire on some part of the brigade front. In such cases the means of obtaining such fire from machine guns are simplified if the brigade commander has some machine guns under his immediate control.

6. The following are alternative ways by which machine-gun support in the attack can be arranged for within an infantry brigade :—

- i. Machine-gun platoons may be left in the hands of their respective battalion commanders. This course will usually be expedient during the preliminary stages of an encounter attack or when little opposition is expected and increased machine-gun support is not likely to be required by the forward battalions, or when the brigade is operating on an abnormally wide frontage.
- ii. The machine-gun platoons of the forward battalions may be left in the hands of their respective battalion commanders, the remainder of the machine guns being under brigade control. This method may be adopted when little information is available as to the nature and extent of the resistance to be encountered. It affords sufficient machine-gun power to the forward battalions while it leaves in the hands of the brigade commander the necessary reserve of fire power to meet any circumstances which may arise.

iii. In addition to their own machine guns a proportion of those belonging to other battalions may be allotted for the support of one or more of the forward battalions, the remainder being left in the hands of their own battalion commanders or placed under brigade control. This distribution may be necessary owing to difficulty in arranging for artillery support, for reasons of ground, or to afford additional protection to the flanks of the forward battalions. Circumstances, however, may render it advisable that such additional support shall be afforded by machine guns operating under brigade control. On the other hand, the lie of the ground or difficulties of communication may make it necessary to place the control of the extra machine guns in the hands of the battalion commanders concerned, as stated above.

iv. All the machine guns of a brigade may be placed under brigade control in circumstances where it is considered that the attack can best be furthered by the co-ordinated action of all the machine guns. These circumstances are most likely to arise in the deliberate attack when the nature of the ground is such that the forward battalions can be supported only by machine guns operating in the area of a neighbouring battalion or formation.

These considerations apply equally to the machine guns of a cavalry brigade when the latter are engaged on operations for which infantry would usually be employed.

7. In rear guard actions and retirements machine-gun squadrons and platoons should, as a rule, remain under the

control of their unit commanders. In the defence of a position, however, owing to the necessity of the careful co-ordination of artillery and machine-gun tasks, it may be advisable to place all the machine guns under brigade control.

8. When machine guns are under brigade control, the duties of the brigade machine-gun officer may be summarized as follows :—

- i. To prepare for the approval of the brigade commander, the plan of operations for the machine-gun squadrons or platoons of the brigade, both in offence and defence, and to co-ordinate these plans with those of the brigades on either flank.
- ii. To prepare, for brigade orders, a paragraph embodying the plan of operations for the machine guns.
- iii. To issue direct to machine-gun squadron or platoon commanders such purely technical instructions as may be necessary to ensure the efficient performance of their part of the plan.
- iv. To be responsible for keeping units informed as to the dispositions of the machine guns covering their respective sectors and to ensure that close and constant liaison is maintained with infantry, artillery and other arms.
- v. To supervise the siting and construction of machine-gun emplacements in the brigade area.

In order that the brigade commander's plan of machine-gun action may be adhered to, unit commanders must not alter the disposition or tasks of machine guns unless a new and unforeseen tactical situation has arisen which is not covered by the original rôles allotted to the machine guns in the brigade

plan. Should a new and unforeseen situation arise, however it is the duty of unit commanders to issue fresh orders to the machine-gun commander, at the same time informing superior authority of the action taken.

9. The situations given in the remainder of this chapter are based on the characteristics outlined in Chapter XIII, and are applicable irrespective of whether machine-gun squadrons or platoons are operating with the units to which they belong or are under brigade control.

#### 79. *Surprise*

The material and moral results obtained by machine-gun fire opened unexpectedly on suitable targets can hardly be over-estimated, and every opportunity for securing surprise effect must be sought.

#### 80. *Cover and concealment*

1. Sustained fire and surprise effect are both dependent upon the skilful use of ground and cover while the machine gun is being brought up to its position, and when it is in action. Although only three men are required to be actually with each gun when in action, the movement necessitated by supply (i.e., ammunition, water, oil, &c.) renders careful choice of gun positions essential if concealment is to be obtained. Such concealment may confer immunity from fire.

Air reconnaissance reduces to some extent the possibilities of complete concealment, but by careful siting and the use of camouflage machine guns will escape observation from the air.

2. Groups of horses and wagons in the open are easily seen from the air, and even when the machine guns are not visible may be an indication of their presence. Every step must therefore be taken to ensure concealment of led horses and limbers.

3. Concealment, both as regards position and manoeuvre, must be foregone if adequate reasons present themselves.

#### 81. *Harassing fire*

1. The objects of harassing fire are to lower the enemy's morale, impede his movement and dislocate his communications. Harassing fire will generally be carried out at night or in foggy or misty weather.

2. After a successful attack harassing fire may be employed with a view to preventing the enemy reforming on a new position.

3. During a period of position warfare, the execution of harassing fire must never be allowed to become a mechanical and perfunctory performance. It should be carried out in short bursts of varying duration at irregular intervals and whenever possible from improvised positions, so as to avoid disclosing the actual battle emplacements.

4. To obtain the best results, machine-gun harassing fire should be carried out in co-operation with the artillery, the general plan being based on information provided by the intelligence branch of the general staff.

#### 82. *Co-operation*

1. Co-operation is the foundation upon which successful machine-gun tactics rest. To ensure it, the closest possible liaison must be maintained.

2. The intentions of a commander for any operation should be communicated to the machine-gun officer in the form of general instructions. It is important that latitude should be allowed to the machine-gun officer in deciding upon the dispositions and methods of fire by which the general instructions can best be carried out, as the application of machine-gun fire differs in many important respects from that of rifles or Lewis guns. Similarly, orders given by the machine-gun officer to his subordinates should generally be given as tasks in order that initiative may not be fettered when dealing with local conditions and unforeseen developments.

3. The object of the employment of machine guns is to support by fire the action of other troops. This support can be ensured only if the machine-gun officer possesses a sound knowledge of the tactics of other arms, and seeks mutual understanding by means of personal liaison on all occasions. Similarly, the best results can be obtained only if commanders possess a general knowledge of the correct method of employing machine guns and the scope of their fire.

4. It is essential that there should be the closest co-operation between the machine guns and the troops they are supporting. All machine-gun commanders must know the detailed plan of the operations in which they are to take part; similarly, commanders must be fully aware of the rôle and dispositions of the machine guns supporting them. During the battle it becomes more than ever important that machine-gun commanders and commanders of the troops they are supporting should keep one another informed as to the progress of the fight and the action which is being taken.

5. Whenever a machine-gun commander is allotted a task necessitating co-operation with a certain force of cavalry or

infantry, whether he is placed under the orders of the commander of that force or not, it becomes his duty to open communication with its commander, reporting to him in person, if possible, in order to obtain full information as to the character of the operation in which he is to co-operate, as to the proposed method of its execution and the task allotted to the machine guns.

6. Co-operation between artillery and machine guns is necessary in order that the whole scheme of fire power, in either attack or defence, may be brought into play with the maximum of effect.

### 83. *Tactical control*

1. Tactical units must be kept intact and the number of tactical units employed must be sufficient for the task in hand.

2. In the case of infantry machine guns, if tactical considerations necessitate movement or disposition by sub-sections, such movement or disposition must permit of general control by the section commander, *i.e.*, sub-sections must be disposed in depth rather than at wide intervals laterally.

### 84. *Reconnaissance*

1. The time available for reconnaissance will vary according to the nature of the operation in hand; thus, in an encounter attack, or in the case of machine guns supporting cavalry in a mounted attack, little if any time may be available for reconnaissance, since the situation may require instant action.

The guiding principle is that, whenever possible, personal reconnaissance should be carried out by commanders before



troops are committed to an engagement. (See Sec. 37, F.S.R., Vol. II, 1924.)

2. The methods to be adopted by a machine-gun commander when reconnoitring in touch with the enemy have been dealt with in Sec. 42.

In a deliberate attack a machine-gun commander must make himself acquainted by a close study of maps and aeroplane photographs, and by personal reconnaissance, with the ground over which the attack is to take place. He must take into consideration :—

- i. Positions from which initial covering fire can best be delivered.
- ii. Suitable places for fire positions as the advance progresses.
- iii. The best routes of advance and any natural obstacles likely to be encountered, both as regards personnel and transport.
- iv. Tactical features or other landmarks which will act as guides during the advance.
- v. The character of the enemy's defences and obstacles which will be encountered by the advancing troops at the various stages of the attack, and the facilities for machine-gun support.
- vi. Where the greatest difficulties are likely to be encountered by the troops which the machine guns are supporting.
- vii. Whether the flanks are liable to become dangerously exposed.
- viii. The assembly positions and covered approaches most likely to be used by the enemy for counter-attacks.

3. A proper distribution of guns and allotment of tasks can only be decided upon after weighing all the above considerations, and in this connection it is well to note that the more it is possible to lighten the tasks of the machine guns at the outset of an attack the more vigorously will they be able to intervene in its later stages, when the artillery support may be thinner and the enemy's resistance possibly stiffening.

4. Before undertaking a reconnaissance to decide on machine-gun positions in defence, a machine-gun commander must be informed as to :—

- i. The general line in front of which it is intended to stop the enemy.
- ii. The tactical features or localities which it is considered essential to cover by means of machine-gun fire.
- iii. The general dispositions of other troops.
- iv. The general plan of artillery defence.

Unless this information is forthcoming, it will be impossible to select machine-gun positions in accordance with the general plan of defence for all arms.

#### 85. *Tactical use of limbers*

1. The gun and ammunition limbers are essentially a fighting portion of the infantry machine-gun section; the three vehicles of the section must be regarded as an integral part of the section, and must ordinarily be with it.

2. The fullest use must be made of all transport in an offensive operation. Resort must only be made to man-handling when all other means of transport have been found impossible.

In mobile warfare machine guns will often be required to act ahead of the main body of their battalion, in order to

consolidate tactical points already gained by advanced troops. It will often be necessary for machine guns to move faster than the remainder of the infantry—for instance, machine guns, marching near the head of the main guard of an advanced guard, may be required to push ahead and hold ground to cover deployment. Similarly, when an objective has been gained, machine guns are required to push on quickly to that objective. On such occasions where the ground is suitable and the tactical situation permits, limbers should be used for the rapid conveyance of guns and men.

3. If a route can be reconnoitred, or selected after a careful study of maps and aeroplane photographs, and if sufficient latitude can be allowed as to the line of advance, wheeled transport is usually able to reach its destination.

If the ground is likely to prove difficult for limbers it may be advisable to employ limbers either (a) with a full team, or (b) with the leaders carrying guns and tripods on pack saddles.

4. When crossing exposed ground, limbers should gallop for the next cover, and the machine-gun detachments should work their way to it independently. At the section commander's discretion, Nos. 1 and 2 of each gun detachment may be carried on the limbers.

When in action, the limbers can be left under cover close to the gun position, while the animals are taken back to a safe distance. The wagon will then serve as the ammunition reserve, and, if a change of position is ordered, can be loaded ready to move off as soon as the animals are brought up.

5. In operations in close country the use of limbers will be restricted to roads and tracks, whilst in position warfare

there will be little opportunity for the use of limbers owing to the numerous obstacles met with in highly organized defences.

In these circumstances, as well as in mountain warfare, resort must be made to pack transport and man-handling. The employment of pack animals throws a considerable strain on men and animals, both as regards casualties and fatigue. Pack animals are difficult to manage under fire and should not be used unless it is impossible for limbers to reach their destination. One of the main objections, however, in changing from limber to pack is that, unless the additional equipment as laid down in Sec. 26 is available, only one gun and its equipment for each subsection can be carried forward.

#### 86. *Inter-communication and liaison*

1. The highly developed systems of telephonic communication which are possible in position warfare cannot be maintained in mobile warfare. It will very rarely be possible to provide any communication by wire forward of infantry brigade headquarters. Machine-gun commanders must therefore accustom themselves to rely entirely upon other methods of intercommunication, such as visual signalling, dismounted or mounted orderlies, &c.

The two latter should be used sparingly, and then only when all other means of intercommunication have failed.

2. The importance of close liaison between the commanders of the machine guns and of the units they are supporting cannot be over-emphasized. This liaison will be largely facilitated if the headquarters of machine-gun commanders are situated in the vicinity of those commanders. Section

commanders, however, must be in a position from which they can control their guns, and liaison with the commanders concerned can only be achieved if the machine-gun section commanders keep themselves informed by means of orderlies or personal observation as to the tactical situation.

#### 87. *Ammunition supply*

1. The supply of S.A.A. in the field is dealt with in Infantry Training, Vol. II, and the methods therein detailed are generally applicable to the supply of ammunition to machine-gun units.

2. When machine guns are under brigade control, it will usually be necessary to form a brigade reserve of machine gun ammunition by withdrawing one of the ammunition limbers from each machine-gun squadron or platoon. These wagons will normally be grouped together in a selected position, which will be notified to all concerned and will usually be near brigade headquarters, where facilities for inter-communication are available.

3. Until factory filled (stripless) belts packed in special boxes become available, it will be necessary to establish belt filling centres at squadron or platoon headquarters. The principle is that as much belt filling as possible should be done in rear, with a view to minimizing losses in personnel and reducing movement near the gun positions.

4. When a force is acting on the defensive, it is generally possible to provide ample ammunition for the guns. At least 8 belts should be allotted to guns in defensive positions for use in firing on their most important lines of fire. The extra amount necessary for guns detailed to carry out harassing fire can be dumped at the gun positions and will vary according

to the rate of fire ordered and the length of time for which it is required to be maintained.

A forward brigade ammunition dump, from which carrying parties can draw supplies for the guns, should be provided as far forward as it is possible to take transport.

5. The following modifications to the normal methods of ammunition supply apply to position warfare :—

Before the attack is launched, dumps of ammunition for the use of machine guns which are to be employed in the initial covering fire should be formed at the actual gun positions.

In this connection, it must be borne in mind that barrage fire expends large quantities of ammunition.

A certain amount of ammunition should be carried forward by the machine-gun detachments. The amount thus carried must depend upon the distance which is to be travelled, the condition of the ground, and the physical capacity of the men.

The danger of exhausting the detachments unduly must always be borne in mind.

Special carrying parties may be employed to carry forward additional supplies of ammunition.

This is laborious and expensive in men, and should not be resorted to more than is absolutely necessary.

The amount a man is given to carry should not, as a rule, be more than two filled belt boxes.

The supply of ammunition by limbers or pack transport is the normal method, and must be employed whenever possible.

Arrangements may be made for ammunition to be carried forward in tanks, when these are available.

In an emergency, ammunition can be dropped from aeroplanes by means of parachutes. This must, however, be regarded as an abnormal method of supply.

## CHAPTER XV

## PROTECTION

88. *Machine guns with outpost troops*

1. The role of machine guns employed with outpost troops is the production of fire when the outposts are required to resist an attack.

For this purpose, machine guns should be disposed in depth so as to assist in the defence of the outpost position.

The outpost commander may decide to retain a proportion of the available machine guns as a mobile reserve of fire power.

2. Machine-gun defence should be organized to assist primarily in the defence of the localities to which the supports have been assigned and in covering the gaps between piquets. Machine guns may also be usefully employed in sweeping the approaches to the outpost position. (Sec. 57, 10, F.S.R., Vol II, 1924.)

The guns should be disposed in sections or sub-sections according to the nature of the ground and of the task allotted.

As it will be impossible to cover with machine-gun fire all the possible avenues of approach to, or tactical localities within, the outpost position, the outpost commander, or the commander of a sector of the outposts, must inform the

machine-gun officer as to the areas or localities which are considered of the greatest importance to the defence and on which it is desired that the bulk of the machine-gun fire shall fall in the event of an attack.

3. The general principles regarding the siting of machine guns in defence (*see* Sec. 105) and the selection of positions on the ground (*see* Sec. 107) apply generally in the case of machine guns employed in the outpost position.

4. By day, unless the enemy is close at hand, it will not be necessary for machine-gun detachments to occupy their positions, but they should be retained under cover ready to move into position when required. By night, however, machine guns should occupy their positions, and the guns should be layed on pre-arranged lines of fire which should be made known to the commanders of piquets and supports.

5. Machine-gun detachments will not be required to take part in the general observation and reconnoitring duties of outpost troops, but will be required to find their own sentries over machine-gun positions.

89. *Machine guns with an advanced guard*

1. The duties of an advanced guard render it necessary that great fire power should be available in the shortest possible time. An ample proportion of machine guns will, in consequence, usually be allotted to advanced guards, and complete tactical units should invariably be employed for this purpose.

2. The main duties of machine guns with an advanced guard will normally be :—

i. To assist in driving in the enemy's advanced troops by rapid development of fire at the required points.



- ii. To assist in holding any position gained and in covering the deployment of the main body.
- iii. To protect an exposed flank or flanks.

3. Machine guns should be placed well forward in the order of march in order to enable them to come quickly into action.

If an attack on any particular locality becomes necessary, the employment of frontal fire by machine guns, covering an enveloping movement by other bodies of infantry, will usually prove most efficacious.

The bold and skilful handling of the limbers will assume especial importance in the deployment and in the subsequent advance of the machine guns, as the advanced guard presses forward.

Mounted officers, orderlies and scouts on bicycles or on foot will be found invaluable for reconnaissance and inter-communication.

#### 90. Machine guns with a rear guard

1. As a rear guard will usually be required to hold positions with the minimum number of men, an ample proportion of machine guns should be allotted to it.

Experience has shown that well-placed and skilfully-handled machine guns can, with the support of a small number of rifles and light automatic weapons, check for long periods the advance of comparatively large numbers of troops.

2. The principles upon which all rear guard action should be based are laid down in Secs. 51 and 52, F.S.R., Vol. II, 1924.

In the application of these principles, the following points

in connection with the employment of machine guns should be noted :—

- i. Direct fire should be used. Fire should be opened at long ranges on suitable targets, but with due regard to the supply of ammunition. Positions should be selected to give a wide and comprehensive field of fire.
- ii. Machine guns should be disposed mainly on the flanks and should be handled in sections as far as possible.
- iii. Defence in depth must be maintained by the retirement of alternate sub-sections or sections.
- iv. Machine guns should be sited with due regard to the close proximity of suitable covered positions for the limbers and also to the prospects of ultimate withdrawal.
- v. Full use should be made of limbers and pack animals for withdrawal, as well as for forming ammunition dumps in suitable places near positions on which the machine guns will fall back.
- vi. Surprise effect must be sought, but the necessary concealment must not interfere with the mobility which is necessary to ensure that successive withdrawals occupy the minimum amount of time.

3. While the withdrawal of machine guns should not take place until the latest possible moment consistent with the tactical situation, the necessary arrangements should be foreseen and prepared.

These arrangements will involve :—

- 1. The previous selection of positions in rear. If these positions can be sited so as to cover the flanks of

the more forward machine guns, additional power will be given to the defence.

- ii. The reconnaissance of covered lines of withdrawal.
- iii. The close proximity and full use of limbers and pack transport.

4. While, as a general principle, the machine guns of the rear party should be left in rear to cover the withdrawal of the bulk of the infantry, it is essential that a proportion of the infantry should remain to cover the withdrawal of the machine guns. On occasions, however, it may be necessary for the machine guns themselves to be sacrificed in order to cover the retirement of the rear party. In such cases the detachments should withdraw at the last possible moment after putting their guns out of action (see Sec. 107, 4). As soon as the bulk of the infantry has withdrawn and reorganized on its new position, the machine guns which have covered the withdrawal should be released to take up fresh dispositions in depth.

#### 91. *Local protection of machine guns*

1. On the march, or in battle, machine guns will normally be protected by the disposition of other troops.

If, however, machine guns are detailed to carry out a march by themselves, or are placed in an exposed position in hostile territory, it may be necessary to detail an escort to accompany them, since machine guns have only limited means of protecting themselves. If this has not been done it is the duty of the machine-gun commander to apply to the nearest commander of infantry or mounted troops for a suitable escort. The senior officer present, whether machine-gun commander or

escort commander, will issue the necessary instructions to the escort, but the commander of the latter must in either case have a free hand in carrying them out.

2. Every commander is, therefore, at all times responsible for the protection of his command from surprise (Sec. 43, 4, F.S.R., Vol. II, 1924). Nothing can absolve the machine-gun commander from the responsibility of taking steps to ensure his own protection, for which he must not rely entirely on the protection afforded by the dispositions of other troops. When moving from one part of the battlefield to another, scouts must be sent out well to the front and flanks. When in action, machine guns should be able to protect their own front provided there is no dead ground within close rifle range. Any such dead ground or concealed approaches must be kept under continuous observation or frequently patrolled.

## CHAPTER XVI

### MACHINE GUNS IN THE ATTACK

#### 92. *Duties in the attack*

The duties of the machine gun in the attack are :—

- i. To cover by fire the advance of the attacking troops through every stage in the attack, and in particular to apply concentrated fire upon localities which may check the advance.
- ii. To protect the flanks of the advancing troops and to cover gaps between units or formations.
- iii. To deal with counter-attacks, and to hold successive objectives won, upon which the forward companies can rally if driven back.
- iv. To provide a reserve of fire power (Sec. 71, 7, F.S.R., Vol. II, 1924).

#### 93. *Dispositions in the attack*

1. The nature of the duties enumerated above necessitates the disposition of machine guns in depth throughout the attack. Machine guns detailed to support the leading troops will have a full task, and can only to a very limited depth afford protection to the flanks.

On the other hand, the protection of the flanks and the warding off of counter-attacks are tasks which normally go hand in hand.

A further consideration, in drawing up a plan of machine-gun action in the attack, is the necessity for retaining a proportion of the available machine guns as a reserve of fire power, to be used for offensive or defensive action or for replacement of casualties as the situation may demand.

2. The principles on which the employment of machine guns in the attack are based apply to both machine-gun squadrons and platoons.

The methods, however, by which these principles are carried out must vary according to circumstances.

3. Normally, therefore, the machine guns will be divided into :—

- i. Forward guns, whose role is to work forward in immediate support of the leading troops.
- ii. Supporting guns, which will be disposed so as to ; (a) consolidate tactical localities as they are won (thus freeing troops for the further advance) ; (b) cover the flanks ; (c) increase the volume of covering fire where necessary.
- iii. Reserve guns.

4. In order that *continuous* support may be afforded to the attacking troops it will frequently be necessary for supporting machine guns to advance through and beyond the forward machine guns, the latter taking up (temporarily) the role of supporting guns. Normally, therefore, both the forward and the supporting machine guns must operate under the orders of one machine-gun commander.

This system of "leap-frogging" will be particularly necessary in operations in which the advance may be continuous

and may cover considerable distance, *e.g.*, where the enemy has been driven back but is still offering resistance.

On the other hand, in operations in which the attacking force has a limited objective, it will often be advisable for the same machine guns to act as forward guns throughout the operations up to the consolidation of the objective.

5. No hard-and-fast rule can be laid down to determine the proportion of machine guns to be held in reserve, or the actual division into "forward" and "supporting" guns in an attack. The following must be considered when making initial distributions :—

- i. Nature of the operation and role of the attacking force.
- ii. Information as to enemy dispositions and strength.
- iii. Nature of the country.
- iv. Amount of artillery available to support the attack.

As a general rule, the proportion of forward guns should be kept to the lowest possible minimum. The more machine guns detailed for this role, the less will be the depth of the machine gun dispositions. The general distribution at every stage of the attack must be such that :—

- (a) Sufficient machine guns are held in reserve with which to obtain superiority of fire in the event of any serious resistance being encountered.
- (b) Rapid intervention to a flank is possible.
- (c) Adequate distribution in depth is maintained as a defence against possible counter-attack.

6. In an encounter attack in close country, owing to the difficulty of accurately locating the position of our own troops, overhead fire will be subject to greater limitations than in

more open country. In this case the proportion of forward machine guns acting in immediate support of the attacking troops should be increased.

These machine guns should take full advantage of the covered approaches available in close country to push well forward and endeavour to gain surprise effect.

When a deliberate attack in close country is carried out according to a definite time-table and with large scale maps available, indirect overhead fire is feasible, and the necessity for increasing the proportion of forward machine guns will not arise.

7. It may be considered advisable to detail a proportion of the forward machine guns to cover the consolidation. Machine guns so detailed should not be expected to perform other tasks during their advance, as it is essential that they should arrive at their positions with an adequate supply of ammunition.

#### 94. Action of forward machine guns

1. When deployment for action has been ordered, the forward machine guns should move to positions of deployment which must be chosen with reference to :—

- i. The position of deployment of the units which they are to support.
- ii. The proposed route of advance.

In a deliberate attack it will usually be necessary to take up these positions during the night before the attack. In this case previous reconnaissance of these positions is essential, both by day and night, if time permits.



2. The forward machine guns will not necessarily advance from their position of deployment at the same time as the leading troops, neither must the former be tied to them during the advance.

It must be remembered that the weight of the gun, tripod and ammunition loads prevent the machine gunner from keeping up with infantry in a rapid advance.

3. In order that they may be able to afford immediate support to the leading troops, the forward machine guns must be prepared to deal rapidly with any opposition which interferes with the advance or threatens the flanks, to cover gaps in the attack or to hold tactical localities on which the leading troops can rally if driven back.

These duties call for aggressive action, and necessitate readiness to open fire at *short* notice. The line of advance of these machine guns should be the line which will take them with the least possible delay to the points from which they can most effectively engage the enemy. But mere gain of ground should not be attempted if it entails the sacrifice of a position already occupied which affords equal facilities for carrying out the task in hand.

Machine guns are not suited to take part in the close struggle for progress.

Immediate support involves constant vigilance on the part of the machine-gun commander, combined with readiness for immediate action by all ranks. Constant relief is therefore necessary to ensure tired troops being covered by fresh machine gunners. Such reliefs will only be possible when there are sufficient machine guns in reserve.

4. Commanders of forward machine guns will :—

- i. Carry out personal reconnaissance well ahead of the unit.
- ii. As the advance progresses select fire positions which will :—
  - (a) Enable the greatest support to be given combined with the minimum number of bounds.
  - (b) Give command of ground from which fire is likely to hold up the advance.
  - (c) Protect the flanks against counter-attack during the advance.
- iii. Use direct fire whenever possible, as the time taken in applying fire must be as short as possible. Indirect fire, however, should be used when necessary, but time will usually only allow of the quickest method (*i.e.*, "Crest method") being employed.
- iv. As far as possible maintain liaison with the commander of the advancing troops which the machine guns are supporting. Keep him informed of the disposition of the machine guns and the situation in vicinity, and report personally to him from time to time as the tactical situation permits. Liaison is often difficult, but occasionally useful information can be obtained from the headquarters of another unit.
- v. As unexpected situations arise, decide on the immediate course of action. If this action conflicts with the initial plan inform the unit commander concerned of the action taken.

### 95. *Action of supporting machine guns*

1. The supporting machine guns may be employed to carry out the initial programme of covering fire in co-operation with the artillery, whilst the forward guns are in position in readiness to advance in immediate support of the leading troops. Reserve guns may also be employed for covering fire.

The subsequent advance, by bounds, of the supporting guns will be necessary for the purpose of increasing the volume of covering fire on those localities or frontages where, as the situation develops, the resistance is found to be preponderant.

2. In selecting positions for the above purpose the subsidiary tasks of the supporting guns, viz., consolidating successive objectives as they are gained by the leading troops, covering gaps in the attack and affording protection to the flanks, must not be overlooked.

The role of the supporting guns necessitates active forward reconnaissance by the machine-gun commanders in charge of these guns.

3. In a deliberate attack upon a well-organized position the machine guns employed to carry out the initial programme of covering fire should, as far as possible, be sited in inconspicuous positions in the areas of lesser shelling and in places which are usually unoccupied by troops.

When time permits, emplacements should be dug beforehand, and stocked with water and S.A.A., and, if required, a belt-filling shelter should be erected in the vicinity.

Machine guns detailed for employment in the initial programme of covering fire may have to occupy their allotted

positions one or more days before the attack. In such cases, every precaution for concealment must be taken.

Work should be done at night and concealed by camouflage by day.

4. In a deliberate attack, when the depth of the advance is limited, the positions for the supporting guns should, if possible, be chosen with a view to the avoidance of a move during the operation.

Where, owing to the depth of the attack, it is necessary for machine guns employed on the initial programme of covering fire to carry out a move in the performance of their task, this move should invariably be regulated by a timetable, and the approximate location of new positions must be fixed beforehand by means of a careful study of the ground.

Positions where it is probable that the enemy will put down an artillery barrage must be avoided. Camouflage material should be taken forward to assist in the concealment of the new positions.

### 96. *General rules governing the advance of machine guns*

1. When advancing, all machine guns, whatever their immediate roles may be, should move forward by bounds from one position to another along pre-arranged routes. These positions should be reconnoitred by platoon or section commanders during the advance.

2. During the advance concealment must be sought, not only from direct ground observation, but also from the air, and conspicuous points liable to shelling by the enemy's artillery should be avoided.

3. During the initial stages of a deliberate attack, the forward movement of machine guns can generally be fixed according to a time-table, but, as the advance progresses, it will be necessary to give subordinate commanders a freer hand.

4. Every use must be made of limbers (or failing them, pack transport) to get the machine guns forward quickly and to prevent the premature exhaustion of detachments.

5. *Fire and movement.*—The principle that movement should be covered by fire must be thoroughly understood and applied by machine-gun officers. Methods must of course be adapted to the tactical situation at the moment, and to the task in hand, but, in many situations, where it becomes necessary for a machine-gun platoon to move from one position to another, one section should move, covered by the fire (if necessary) of the other section. The latter should only leave the original position when the section which moved first is in the new position. The same method also applies to the sub-sections of a section, and should generally be adopted by machine guns which have been detailed for the protection of a flank, in addition, perhaps, to other duties.

#### 97. *Mutual support and exercise of initiative*

1. The principle of mutual support must always be borne in mind. Thus machine guns, which have been detailed for the immediate support of a particular unit, must always be prepared to cover the advance of a neighbouring unit, if the opportunity should arise.

2. Where the character of the country over which the attack is to be made particularly lends itself to mutual

support, definite arrangements can be made in advance, but such support will be found more often to depend upon the exercise of initiative by the machine-gun commander on the spot.

#### 98. *Fire tactics*

1. The fire of machine guns may be either direct or indirect. Primarily the machine gun is a weapon for direct fire, but indirect fire may often have to be employed to search localities on which direct fire cannot be brought to bear, and to harass the enemy's back areas and communications. Indirect fire also permits of distribution in depth without undue sacrifice of fire power. When a target cannot be engaged by direct fire the machine-gun officer must immediately endeavour to engage it by indirect methods.

2. *Direct fire over the sights at the target is the most effective form of machine-gun fire.* But although frequent opportunities will be forthcoming for employing, with effect, the direct fire of machine guns in mobile warfare, both in attack and defence, the opportunities for using this form of fire to support the attack on highly organized defences are less numerous. Full advantage must, therefore, be taken of the offensive power available in the indirect fire of machine guns to support an attack of this nature, for which purpose barrage fire may often be employed.

3. *Barrage fire by machine guns is the fire of a large number of guns acting under a centralized control, directed on to definite lines in which the frontage engaged by a gun seldom exceeds 50 yards.*

4. Barrage fire is carried out by :—

- i. Artillery.
- ii. Machine guns.
- iii. Mortars (in position warfare only).

In any operation the best results can be obtained only by conceiving the barrage scheme as a whole and allotting to the different arms tasks which their characteristics render them most fitted to carry out. In this connection the limitations of machine-gun range, and the necessities as regards clearances over the heads of our own troops, must be borne in mind when deciding which part of the ground to be barraged is most suitable for the application of machine-gun fire.

5. There are two types of barrage fire :—

- i. *Creeping barrage*.—In which the barrage moves over an area of ground, in which case the machine-gun barrage would be synchronized with the artillery time-table, thus searching the ground over which attacking troops are advancing, or denying the use of certain areas to the enemy, &c. A creeping (machine-gun) barrage goes forward, usually 200 yards at each lift. It is frequently put down 300 to 400 yards (according to safety considerations) beyond the 18-pounder barrage.
- ii. *Standing barrage*.—Put down on a definite line and remaining there as long as required ; used for the protection of troops consolidating, or meeting an attack, &c. It is also used during an

advance, in which case it remains on its line as long as safety and other considerations permit, and may then lift on to a second line further in advance.

6. When bombardment precedes an operation in position warfare, those machine guns which have been allotted for barrage fire usually carry out "harassing fire," which is regarded as an integral part of the preliminary bombardment.

The object of this fire is to :—

- i. Lower efficiency of enemy working parties.
- ii. Increase difficulty of transport of munitions and supplies.
- iii. Cause deterioration of the enemy's morale.

This object can be attained by engaging the following targets :—

- (a) Targets previously engaged by the artillery—more especially wire entanglements and defences which have been damaged.
- (b) Communication trenches which can be taken in enfilade.
- (c) Routes, tracks taken by ration parties and reliefs, dumps, tramways, the areas between communication trenches, &c.
- (d) Any field battery positions which may be within range of machine-gun fire.



By close co-operation between machine guns and other arms it is possible to drive the traffic from overland routes into the communication trenches, thereby causing :—

- (e) Congestion and delay.
- (f) Casualties from the artillery searching the communication trenches with their enfilade guns.

During the period more closely approaching the day of attack when the enemy's defences have been damaged and the morale of the garrison has been shaken, the plan of concentrating the fire of machine guns on to carefully chosen centres of activity, and opening rapid fire for a short period, is effective. This type of fire is known as "Area shooting." This treatment should be applied to different points at irregular intervals.

7. In order that machine guns may carry out the role allotted to them in the general barrage scheme, the machine-gun barrage must fulfil the following conditions :—

- i. It must be applicable equally to the deliberate attack where there is time for preparation, and to the later stages of large operations which involve the forward movement of units to new positions from which to create another barrage.
- ii. It must also apply to conditions of mobile warfare, becoming relatively more important as the troops get out of range of the bulk of their own artillery.
- iii. It must be flexible, *i.e.*, it must be possible to create a zone of intense machine-gun fire on any area within range with accuracy and rapidity.

8. Details regarding the organization of machine-gun barrage fire are given in Appendix XIII.

### 99. *Machine guns in the attack on a wood or village*

1. The attack on a large wood, which cannot be enveloped or passed by, will consist of one or more of the following three phases, each of which will as a rule be entirely different in character, *viz.* :—

- i. The fight for the edge of the wood.
- ii. The struggle in the interior.
- iii. The debouching from the wood on the enemy's side.

2. The attack on the edge of a wood differs in no way from the attack on any other position, and no special comment on the handling of machine guns is necessary, except to point out that machine guns should not be pushed into the wood until it is clear that the attacking troops have made good some extent of ground beyond the near edge, and then only if the best line of advance to their next fire position is through the wood.

3. As soon as a definite lodgment has been secured in a considerable portion of the interior, some of the forward machine guns should be pushed up in close support. In addition to assisting the advance by means of direct fire, these machine guns will be of value in securing the flanks and in assisting to beat off counter-attacks. Care must be taken not to allot tasks to these machine guns which would be equally well performed by Lewis guns.

4. As soon as the wood has been cleared of the enemy and the far edge gained, opportunities should be sought for pushing forward machine guns on the flanks of the wood to positions whence they can support the further advance.

If this is not feasible, owing to the wood being of very

large dimensions, it will be necessary to increase the proportion of forward machine guns to assist the troops in debouching from the wood by means of direct covering fire.

5. In the case of small woods, forming part of a defensive position, the attacker will probably endeavour to outflank and envelop rather than attack them frontally. In this case machine guns will be most usefully employed in covering the enveloping movements by fire directed against the front and flanks of the locality which is being surrounded. For this purpose a large proportion of the available machine guns will be employed with advantage for long range covering and searching fire.

6. As the enveloping movements progress, machine guns should be moved to suitable positions on the flanks of the locality, from which enfilade and oblique fire can be brought against the flanks and rear of the defences. Opportunities for doing so may frequently be offered to forward machine guns detailed to support the troops attacking to the right and left of the wood, from whose progress the enveloping of the wood may result. Long range fire from machine guns can also be used to cover the exits from the wood, thus preventing the arrival of reinforcements and barring lines of retreat to the defenders.

7. The above principles apply equally to the handling of machine guns in the attack on a village.

#### 100. Consolidation

1. The forward machine guns can assist consolidation by covering the troops carrying out the work and assisting in repelling immediate counter-attacks.

2. Where the attack is limited in depth, the arrangements for consolidation should be thought out beforehand in detail; the precision, however, with which instructions on this subject can be issued before the attack must in each case depend on the nature and scope of the operation as a whole.

Arrangements must also be made to utilise the long range fire of supporting machine guns to assist in consolidation by covering definite frontages or areas in front or on the flanks of the leading troops.

By this means greater volume and organized depth will be obtained to deal with deliberate counter-attacks.

3. The following points are of general application:—

- i. A pause in the advance may occur either in accordance with the general plan of attack, or owing to the strength of the enemy's resistance, the exhaustion of the attacking troops, nightfall, or any other cause. When such a pause is anticipated machine-gun commanders should at once reconnoitre the ground with a view to moving their guns, if necessary, into positions more suitable for defence in depth than those which they have occupied during the attack.
- ii. If the attack is likely to come to a standstill at dusk, it is particularly important that final positions should be selected and occupied, and range cards prepared, before the light fails.
- iii. Whenever there is a pause in the battle, and especially at dusk and at dawn, counter-attacks are liable to develop.

At this stage, the troops may be in unfamiliar surroundings, often exhausted by hard fighting, and perhaps somewhat disorganized. Machine guns can do much to protect the position and to safeguard the flanks. This may necessitate the placing of machine guns as a temporary measure in isolated positions, in which case the guns should be accompanied by an escort.

- iv. The advisability of detailing definite machine guns before the attack for the special purpose of consolidating some particular tactical feature depends upon :—

(a) The importance which is attached to the retention of the feature in question.

(b) The likelihood of a counter-attack in strength.

Where no serious hostile reaction is expected, it is usually better to keep machine-gun resources well in hand.

- v. The state of readiness for repelling a counter-attack should be supplemented during the night by a vigorous programme of harassing fire, arranged in co-operation with the artillery, on roads and tracks, covered lines of approach, and possible positions of assembly.

#### 101. *Machine guns in support of cavalry*

1. The principles given in the foregoing sections are applicable generally to the action of machine guns operating in support of cavalry engaged in dismounted action.

2. When supporting cavalry engaged in a mounted attack the chief consideration will be to open fire on the enemy at the correct moment with the maximum number of guns; quickness of decision and speed in coming into action are therefore of first importance.

To ensure effective co-operation the machine-gun commander should accompany the commander of the cavalry unit or formation until the moment when the machine guns are required to be brought into action, and the former must be kept fully informed regarding the situation and the intentions of the commander.

3. The principal tasks for which machine guns are specially suitable are :—

*In the attack :—*

- i. To support a mounted or dismounted attack.
- ii. To repulse counter-attacks and to form a rallying point after an attack.
- iii. To form a defensive flank and so allow mounted men to retain their mobility.
- iv. To assist in consolidating a position which has been captured.

*In the defence :—*

- i. To bring concentrated fire on selected lines of approach both by day and night.
- ii. The defence of the flanks.
- iii. To bring fire to bear on concentrations of the enemy at ranges up to 1,500 yards.

### 102. *The machine-gun platoon operating with its battalion*

1. The principles expressed in the foregoing sections are applicable generally to the handling of a machine-gun platoon operating with its battalion.

2. The machine-gun platoon consists of two sections; each section is a complete tactical unit in itself, and is sub-divided into two sub-sections.

The sub-section of machine guns, however, is not a tactical unit.

3. It follows that the division of a single machine-gun platoon into three parts, viz. :—

- i. Forward guns,
- ii. Supporting guns,
- iii. Reserve guns,

is not practicable without breaking up tactical units, which leads to absence of control and dissipation of fire power, and must be avoided. Sufficient depth in the machine-gun dispositions in the attack will be obtained if the two sections of the machine-gun platoon are utilized to perform two of the three roles mentioned above.

4. In determining on the role of his machine-gun platoon in the attack, the first consideration of a battalion commander must be whether he will retain the whole or a portion of the platoon in reserve during the initial stages of the attack. In making a decision on this matter, a battalion commander will be guided by the considerations given in Sec. 93, 5.

In an encounter attack it will usually be advisable to retain in reserve one or both sections of the platoon until the

situation is sufficiently clear to indicate on what portion of the battalion front machine-gun fire is most required.

In a deliberate attack it may be expedient to utilize the whole platoon to afford covering fire during the initial stages of the attack, subsequently pushing forward one section for the immediate support of the forward companies whilst the other section is held temporarily in reserve, or is sent forward to assist in holding a tactical locality already gained.

5. Before an attack is launched, the battalion commander must inform the machine-gun platoon commander on the following points :—

- i. The objective or objectives to be gained.
- ii. The frontage allotted to the battalion.
- iii. Whether any special measures are to be taken by the machine guns as to the protection of one or both flanks.
- iv. The nature and the amount of artillery support available.
- v. The tactical localities which it is essential should be made good during the advance.
- vi. Any particular measure required to be taken by the machine guns to assist in consolidation of the final objective.

6. On receipt of the above information, the platoon commander will decide on his plan of action, for which purpose he must, if time permits, carry out personal reconnaissance (see Sec. 84) not only of the ground over which the battalion is to advance but also of the ground on both flanks of the frontage allotted to the battalion.



7. If the battalion commander has decided to retain one machine-gun section in reserve, the platoon commander must issue instructions for the action of the remaining section, which should normally be detailed for the immediate support of the forward companies, and will then perform the duties of forward guns as laid down in Sec. 94.

8. If the battalion commander places both sections at the disposal of the platoon commander, the latter must allot tasks to the two sections in such a manner as to ensure that the platoon is disposed in *depth* throughout the advance. For this purpose he may detail one section to act in the role of forward guns, for the immediate support of the forward companies, retaining the other section more directly under his control, to act in the role of supporting guns, *i.e.* for the consolidation of tactical localities, the protection of a flank or the increase of covering fire on any part of the battalion front as required.

9. In the tactical handling of the two sections on the lines indicated above, in order that *continuous* support may be afforded to the forward companies, "leap-frogging" between the two sections will often be necessary. (*See* Sec. 93, 4.) It will be for the platoon commander to decide when the rearmost section should be sent forward to take up the role of forward guns, or when it should be brought into action to increase the volume of covering fire on any particular locality.

In order that he may control such moves and ensure that they are carried out at the right time, the platoon commander must be in a position to watch the advance of the battalion and be in close touch with the rearmost section of his platoon. The platoon commander should not, therefore, be tied to his battalion headquarters during the advance.

10. In order that the best possible support may be afforded to the forward companies during the advance, it is essential that the platoon commander should retain general control of his sections.

For this reason machine guns should rarely be allotted to companies. It will frequently be necessary for machine guns to come into action from positions on the flank of, *i.e.*, outside, the frontage allotted to the battalion.

The distance from the flank of the battalion at which the machine gun should operate will be limited by considerations of liaison and inter-communication.

11. The platoon commander is responsible for the supply of ammunition to his sections.

### 103. Machine-gun platoons under brigade control

1. In order that he may prepare a comprehensive plan for the action of the machine guns, the brigade machine-gun officer must receive instructions on the following points:—

- i. The proportion of the available machine guns which the brigade commander intends to retain in reserve.
- ii. The objective or objectives to be gained.
- iii. The frontage allotted to the brigade.
- iv. The nature and amount of artillery support and whether any particular steps are to be taken as regards co-operation between the machine guns and the artillery.
- v. The tactical localities which it is essential should be made good during the advance.

- vi. Whether the role of any battalion necessitates special machine-gun support.
- vii. Whether any special measures are to be taken by the machine guns as regards the protection of one or both flanks, or to assist in consolidation of the final objective.

2. In drawing up a plan of machine-gun action in the attack, the brigade machine-gun officer will be guided by the principles enunciated in Sec. 93. After final approval by the brigade commander, orders for the machine guns will be issued in brigade orders for the attack.

The nature of the ground is a factor which he must weigh carefully. The ground will not always be equally suitable for machine gun action on the whole of the brigade front, and it will often be necessary for some, or even the bulk, of the machine guns to operate outside the area covered by the brigade.

3. As pointed out in Sec. 93, 4, it will often be desirable for both the forward and the supporting machine guns to operate under the orders of one machine-gun commander. If, in the particular operation in hand, it is not considered practicable for the brigade machine-gun officer to control the action of both the forward and the supporting machine guns, it will be necessary to allot the former to the support of definite battalions. In such cases the forward machine guns will act under the orders of the battalion commanders concerned for such period or phase of the operation as may be defined by the brigade commander and made clear to all concerned.

4. Whether the forward machine guns are acting under his orders or not, the brigade machine-gun officer must be in a position to control the movements and action of the supporting machine guns.

In the initial stages of a deliberate attack it will generally be possible to allot beforehand definite tasks to these machine guns.

But, as the advance progresses, constant changes in the tactical situation will necessitate the intervention of some or all of the supporting machine guns on any part of the brigade front.

5. The brigade machine-gun officer must take advantage of pauses in the operation to review the machine-gun situation generally, to satisfy himself that the machine guns are disposed in sufficient depth, and to consider the advisability of the employment of reserve guns, of carrying out reliefs, &c. He will often find that the guns have become over-concentrated or too much dispersed in the course of the fighting, and he may have to arrange their regrouping.

6. In order that he may regulate the supply of ammunition to the machine-gun platoons in accordance with the tactical situation, the brigade machine-gun officer must control the movements of the brigaded machine-gun ammunition limbered wagons.

## CHAPTER XVII

## MACHINE GUNS IN THE DEFENCE

104. *General considerations*

1. The principles of defence are laid down in Chapter IX, F.S.R., Vol. II, 1924.

2. The object of the defending troops is to inflict the maximum loss on the enemy at the least expense to themselves, and so to wear down his fighting power, whilst maintaining their own, that they will be able at a suitable time to resume the offensive and complete his defeat; therefore everything possible must be done to economize man power in the defence, in order that the maximum power may be available for eventual offensive action (Sec. 88, 3, iii, F.S.R., Vol. II, 1924).

Machine guns, by reason of their great fire power, will assist materially in effecting the economy mentioned above.

3. The framework of the defence will be the artillery and machine guns. The position must therefore be chosen largely from an artillery and machine-gun point of view, and should permit of good ground observation and good concealment for the guns, while denying these advantages to the attacker. (Sec. 89, 5, F.S.R., Vol. II, 1924.)

When planning new defences, the fields of fire for machine guns should be laid out before the lines of any trench system

are determined in detail. It will then be possible to make full use of the ground with a view to the most advantageous application of machine-gun fire. This method of preparing the organization of the defence is of especial importance in flat country where the field of fire cannot be increased by moving machine guns to higher ground. Care must be taken while the defences are in process of construction not to block the fields of machine-gun fire which have been decided upon.

4. Once the enemy has launched an attack on a large scale the action of the machine guns, other than those in reserve, will be governed by the tasks allotted to them beforehand in the plan of defence. Machine-gun defence will probably develop into a series of local actions, each involving the most stubborn defence of important tactical localities. So far as the machine guns allotted to the defence of a position are concerned, any position they are ordered to defend must be held to the last, or until they receive orders from superior authority to withdraw. As long as machine gunners are still holding out, no position can be regarded as lost, and the delay thus caused to the enemy's attack may gain time for the development of a successful counter-attack.

105. *Dispositions in the defence*

1. The disposition of the machine guns in depth must be based upon definite plans for the restriction of the area into which an attacking force may penetrate. They must be so disposed as to ensure the formation of a defensive flank in either direction in the event of a penetration of the defensive system at any point of tactical importance, and

to support an immediate counter-attack for the recovery of the lost ground. They must also be distributed so that if the enemy succeeds in overcoming the forward troops, his farther advance may be checked by the machine guns in rear until the necessary measures can be taken to restore the situation. In the organization of the machine-gun defences, the closest co-operation is necessary between neighbouring units and formations and between machine guns and the other arms.

2. In determining on the disposition of machine guns in the defence, due consideration must be given to the necessity for retaining a portion of the available machine guns as a mobile reserve, to be used either (a) to co-operate with troops detailed to carry out a counter-attack (*see* Sec. 103), or (b) to stiffen the defence if necessary.

3. No attempt should be made to site machine guns so that every yard of ground is swept by their fire.

Machine-gun fire should be used to cover the more important features and to deny to the enemy the most favourable routes of advance, such as the gaps between tank obstacles. It may be employed to stiffen the defence of areas already covered by artillery or mortar fire or to defend areas which the artillery cannot cover.

Localities of tactical importance must be strongly covered, even though it becomes necessary to leave gaps on parts of the front where an attack is less probable.

Generally speaking, machine guns should be sited so that their fire will cover the ground on which the enemy is likely to present the best targets.

4. At close and effective ranges, the machine-gun defence of a tactical feature is ensured in the most economical manner

by means of enfilade fire, *i.e.*, by placing the machine guns away from and on the flank of, rather than on, the feature. Consequently, machine guns will not necessarily be sited in the area of the unit whose front they are covering.

5. The employment of machine guns singly must be avoided. If the machine-gun defence is based upon the disposition of the guns singly, the loss of one machine gun might disorganize the whole system of defence. Machine guns should be employed in sub-sections or sections, in order to secure sufficient volume of fire, to facilitate control, and to inspire mutual confidence between the gun detachments. (*See also* Secs. 48 and 83.)

6. In position warfare, the main consideration in the distribution of machine guns is the defence of the main zone.

Only a small proportion of the available machine guns should be allotted to the forward zone, these guns being detailed for tasks which cannot adequately be carried out by the Lewis guns. If the front line of the forward zone is liable to bombardment by heavy artillery or mortars, it is usually undesirable to place machine guns in it. (Sec. 100, 6, F.S.R., Vol. II, 1924.)

Even if machine-gun detachments are accommodated in deep dug-outs near the front line, their chance of coming into action is small, since by the time they have mounted their guns the enemy may have over-run the gun positions.

#### 106. Fire tactics

1. The fundamental principle upon which the plans for defence must be based is the power of the machine gun to



arrest the progress of the enemy by *direct* fire at effective and close ranges.

2. In addition, long range fire, preferably direct, can be used in order to harass and to break up troops advancing in close formation. It can also be used to assist in disorganizing the enemy during the opening stages of an attack if it is directed on to the most likely avenues of approach.

The employment of long range fire will be limited by :—

i. The necessity for retaining at the machine-gun positions a minimum of 2,000 rounds a gun (in filled belts) for close range fire.

ii. The undesirability of disclosing the machine-gun positions.

3. Indirect fire can be employed where it is not possible to deal with the target by direct fire. This may often be the case when targets which have to be engaged at long range cannot be seen from a machine-gun position, or when smoke, mist or darkness prevent any target whatever from being seen. For this reason all machine guns normally sited for direct fire must also be able to fire on their lines by indirect means if necessary.

Once the enemy has penetrated the defensive position it will usually be impossible to engage him with indirect fire owing to the difficulties of observation of fire, and the uncertainty of his positions.

4. All the considerations contained in the preceding paragraphs must be taken into account when working out the plan of machine-gun defence, and it follows that all machine guns sited in fixed positions **must first be disposed in**

**depth with the object of defending tactical localities with direct fire at effective and close ranges.**

When this has been done, as many of these machine guns as possible should be utilized for long range fire—direct or indirect—according to circumstances. Machine guns so employed therefore will have two main rôles :—

i. The more important rôle, *i.e.*, direct fire at effective and close ranges ;

ii. Long range fire which will usually entail indirect fire.

5. Careful co-ordination is required between artillery and machine guns in the preparation of the scheme. This will entail ample time being available for reconnaissance in order to decide which areas or localities are to be covered by artillery and machine-gun fire respectively.

#### *107. Selection and occupation of positions on the ground*

1. Once the general distribution of the machine guns in the scheme of defence has been settled, and an approximate idea of their locations has been formed, it will be necessary to select the actual positions on the ground.

The following considerations must be taken into account :—

i. An extensive range along the most important line of fire is essential : if possible, this range should not be less than 800 yards, for guns sited in sub-sections, and not less than 1,500 yards for guns sited in sections.

ii. The field of view should be as wide as possible in order to enable the machine gunners to engage

other targets when the most important area of fire is clear.

- iii. Alternative positions must be selected as soon as the original position has been chosen.

The occupation of alternative positions may be necessary in order to : (a) repel attack from an unexpected direction, or (b) avoid destruction by artillery fire in case the original position is discovered by the enemy's aircraft.

- iv. No rule can be laid down as to the siting of machine guns in a clearly defined trench system. Guns sited in trenches are likely to come under concentrated artillery fire, but, on the other hand, they are more easily moved and visited in daylight.

Where a position can be sited in the open without any indications (*e.g.*, tracks to the position, traces of work, shadows, &c.) being afforded to the enemy either from the ground or from the air, it may escape deliberate shelling at the outset of the attack, and the field of fire will be less restricted, especially in flat country.

The nature of the emplacement must also be considered (*see* Manual of Field Works (All Arms).)

- v. In undulating country, valleys which lead from the enemy's positions will form likely avenues of approach. Machine guns should be posted at the heads or along the sides of such valleys, so as to command them.

- vi. Normally the field of fire inside a village will be restricted and therefore, as a general rule, only a few, if any, machine guns should be sited inside it.

- vii. Machine guns should not be sited near a conspicuous or obvious landmark (*e.g.*, an isolated ruin, an isolated clump of trees, cross-roads, trench junctions, &c.), nor should a position be chosen which is likely to be subjected to heavy artillery fire.

- viii. Machine guns may be sited in the cellars of a group of ruined houses, as it will be difficult for the enemy to locate their exact positions; but it must be remembered that carbon monoxide gas may render ill-ventilated emplacements untenable if much firing is carried out. Similarly, a large wood lends itself to defence by groups of machine guns, as the foliage and undergrowth give ideal facilities for concealment, even of comparatively large field works. The advance of the enemy should be diverted by well-arranged obstacles and, if necessary, clearings, which are swept by machine-gun fire.

- ix. Wire obstacles sited in connection with machine-gun fire may be classed as tactical or defensive. Tactical wire is carefully sited, with the object of forcing the enemy into definite areas or along routes upon which machine-gun fire can be brought to bear. Defensive wire is that which is sited in order to afford local protection to machine-gun positions; it is not necessarily covered by the fire of the machine guns it directly protects,

but must be covered from neighbouring machine-gun positions or else by rifle fire. It is not advisable to site a machine-gun position at the apex of a wire entanglement, as the enemy is bound to suspect its presence. Only dummy emplacements should be constructed at such points; the guns should be in a concealed position to a flank or in rear.

- x. In selecting a position due regard must be had to its concealment both from ground observation and from the air. Every machine-gun officer should be familiar with the principles and practice of camouflage. (*See Appendix X, Manual of Field Works (All Arms), 1925.*)

Combined with the skilful use of natural and artificial camouflage, mobility, alternative positions, frequent changes of position (where practicable) and dummy positions should all be employed to deceive the enemy's observers.

- xi. Machine guns in rear can often be sited so that their fire will protect the flanks of the more forward guns, but this is a secondary consideration, and must not restrict local defence by direct fire at effective and close ranges.
  - xii. The importance of adequate cover for the machine-gun detachments must be remembered.
  - xiii. Liaison between the engineers and machine gunners must be maintained in order that the most effective use may be made of obstacles and field works.
2. When a position is selected on a forward slope, there

should be some covered approach by which access to the gun may be maintained.

Traces of occupation of an isolated position are difficult to avoid; during the day it will often prove advisable for the detachments to live at some little distance from the machine-gun position, if they can reach it by a disused trench or some covered approach.

3. Machine guns should not be fired prematurely from the positions which they will occupy in the event of an attack. Alternative positions must be prepared from which to carry out harassing fire.

4. Every machine-gun detachment should have with it the means for destroying the gun should necessity arise. A hand grenade placed on the breech casing is sufficient.

#### 108. *Action of the reserves*

1. In all plans for counter-attack, whether drawn up beforehand or made on the spur of the moment, the covering fire of machine guns, preferably firing direct and from a flank, must be included.

Previous reconnaissance in close conjunction with the commanders of the units which they are supporting should enable machine-gun commanders to determine approximately the areas in which counter-attacks may have to be delivered. The latter will then be able to select positions from which direct observation of the counter-attack may be possible.

The reserve machine guns must retain their mobility in order that they may be able to move quickly when required either to protect the flanks or to support troops detailed to carry out a counter-attack.

109. *Retirements*

1. Although the enemy's advance does not necessarily entail the withdrawal of the machine guns, such a withdrawal may be ordered by superior authority in order to conform with the movements of troops on the flanks. It is essential therefore that plans for a possible withdrawal should be prepared beforehand.

2. The success of any such operation will depend upon :—

- i. The plan being communicated to, and thoroughly understood by, all concerned.
- ii. Co-ordinated action by the various arms.
- iii. The determination of all ranks that the enemy must be made to suffer heavy casualties for any gain of ground which he may make.

When moving from one position to another, machine-gun units must be assisted by covering fire from other troops, as machine gunners cannot move their equipment and use their rifles at the same time.

110. *The machine-gun platoon operating with its battalion*

1. A comprehensive plan for the action of machine guns is of such value in the general scheme of defence for a force of all arms, that it will be expedient to leave machine-gun platoons with their battalions only when circumstances render it impracticable to prepare such a plan.

The occasions on which such circumstances will arise may be summarized as follows :—

- i. A single battalion may be detailed to cover the front of a brigade.

In such a case the battalion will be performing the rôle of outpost troops and the disposition of the machine-gun platoon will be made on the lines indicated in Sec. 88.

- ii. When time is not available, as will often be the case in mobile warfare, for the detailed reconnaissance which is necessary before a comprehensive plan of machine-gun action can be prepared.
- iii. When a brigade has to occupy such an abnormally wide frontage that there can be little depth in its dispositions.

In the case of either ii or iii above, the machine-gun platoons of battalions furnishing forward bodies must be disposed by battalion commanders in accordance with the principles enunciated in the preceding sections, care being taken that co-ordination of machine-gun effort is arranged for on the flanks of the neighbouring battalions.

2. Before he can submit a plan for the dispositions of the machine-gun platoon, which must be based on the principles in the preceding sections, the platoon commander must be furnished with information on the points mentioned in Sec. 84, 4, and must know what proportion (if any) of the platoon the battalion commander intends to retain as a mobile reserve.

111. *Machine-gun platoons under brigade control*

1. When he decides to adopt a comprehensive plan for the action of the available machine guns, a brigade commander must consider the brigade sector as a whole and make an allotment suitable to the ground irrespective of the actual frontages allotted to battalions.



The protection of one or both flanks, or the nature of the ground, will often make it necessary to allot a larger number of machine guns to the defence of the area occupied by one battalion than to that occupied by another battalion.

2. Having received information on the points mentioned in Sec. 84, 4, and as to the proportion (if any) of the available machine guns which the brigade commander intends to retain as a mobile reserve, the brigade machine-gun officer, after carrying out the necessary reconnaissance, will submit a plan for the disposition of the machine guns in accordance with the principles already enunciated.

3. The brigade machine-gun officer must ensure that battalion commanders are fully aware of the nature and amount of machine-gun support which is to be afforded to their battalions. He will also be responsible for working out, in conjunction with the artillery staff, the technical details which are necessary to ensure co-ordination of machine-gun and artillery fire.

If at any time the tactical situation should develop in such a way that the battalion commander considers the dispositions of the machine guns located in his sector require to be altered, he will order the machine-gun commander on the spot to make the necessary changes, reporting his action immediately to brigade headquarters.

## APPENDICES

### APPENDIX I

#### RANGE TABLE

303-in. Vickers machine gun, Mark VII ammunition

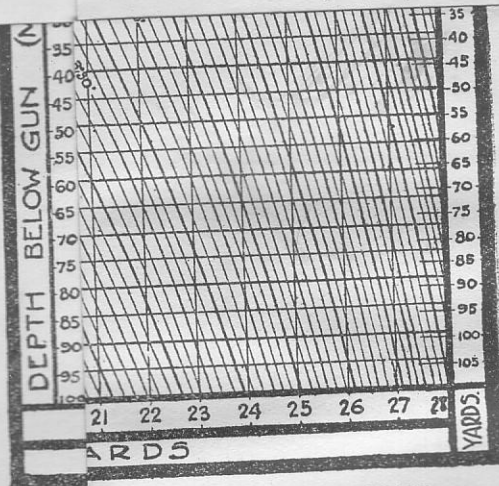
1	2	3		4	5	6		7
Range (Yards)	Tangent Angle	Slope of Descent		Height in Yards of Lowest Shot below Centre of Cone	Height of Cone in Yards	Dimensions in Yards of Horizontal Beaten Zones		Time of Flight, Seconds
		As an Angle	As a Gradient			Width	Length	
100	3'	—	—	—	—	—	—	—
200	7'	—	—	.7	—	—	—	.2
300	11'	—	—	1.0	—	—	—	.4
400	16'	15'	230	1.3	—	—	—	.6
500	22'	23'	149	1.7	3.3	2.3	700	.8
600	28'	32'	107	2.0	4.0	2.8	600	1.0
700	35'	42'	82	2.3	4.6	3.3	525	1.25
800	43'	54'	64	2.7	5.3	3.8	450	1.5
900	52'	1° 9'	50	3.0	6.3	4.3	375	1.75
1000	1° 2'	1° 28'	39	3.3	7.3	5.0	300	2.0

## APPENDIX I—continued

## RANGE TABLE—continued

1	2	3		4	5	6		7
Range (Yards)	Tangent Angle	Slope of Descent		Height in Yards of Lowest Shot below Centre of Cone	Height of Cone in Yards	Dimensions in Yards of Horizontal Beaten Zones.		Time of Flight, Seconds
		As an Angle	As a Gradient			Width	Length	
1100	1° 13'	1° 51'	31	4.0	8.3	6.0	270	2.36
1200	1° 26'	2° 19'	25	4.7	9.6	7.0	240	2.65
1300	1° 41'	2° 52'	20	5.3	11.0	8.0	210	3.0
1400	1° 57'	3° 29'	16	6.0	12.6	9.0	180	3.4
1500	2° 15'	4° 11'	14	6.7	14.3	10.0	160	3.8
1600	2° 35'	4° 58'	12	7.3	16.3	11.3	150	4.2
1700	2° 57'	5° 50'	9.8	8.0	18.6	12.7	145	4.7
1800	3° 21'	6° 47'	8.5	8.7	21.3	14.0	140	5.2
1900	3° 47'	7° 49'	7.3	9.3	24.0	15.3	135	5.8
2000	4° 16'	9° 1'	6.4	10.0	27.3	16.7	130	6.4
2100	4° 48'	10° 23'	5.5	13.3	31.3	18.0	140	7.1
2200	5° 22'	11° 55'	4.8	16.7	36.0	19.3	150	7.8
2300	6° 0'	13° 37'	4.2	20.0	42.0	20.7	160	8.6
2400	6° 41'	15° 29'	3.7	25.0	50.0	22.0	170	9.5
2500	7° 27'	17° 32'	3.3	30.0	59.0	23.3	180	10.5
2600	8° 16'	19° 46'	2.9	35.0	70.0	25.0	190	11.7
2700	9° 11'	22° 12'	2.6	41.7	83.0	26.7	200	13.0
2800	10° 10'	24° 51'	2.3	48.3	96.0	28.3	210	14.4

[To face page 354]



CLEARANCE IN METRES  
CLEARANCE IN YARDS  
GUN.

Ho height of target above or below

Tes vertically above a point plotted  
on). This gives clearance in yards.

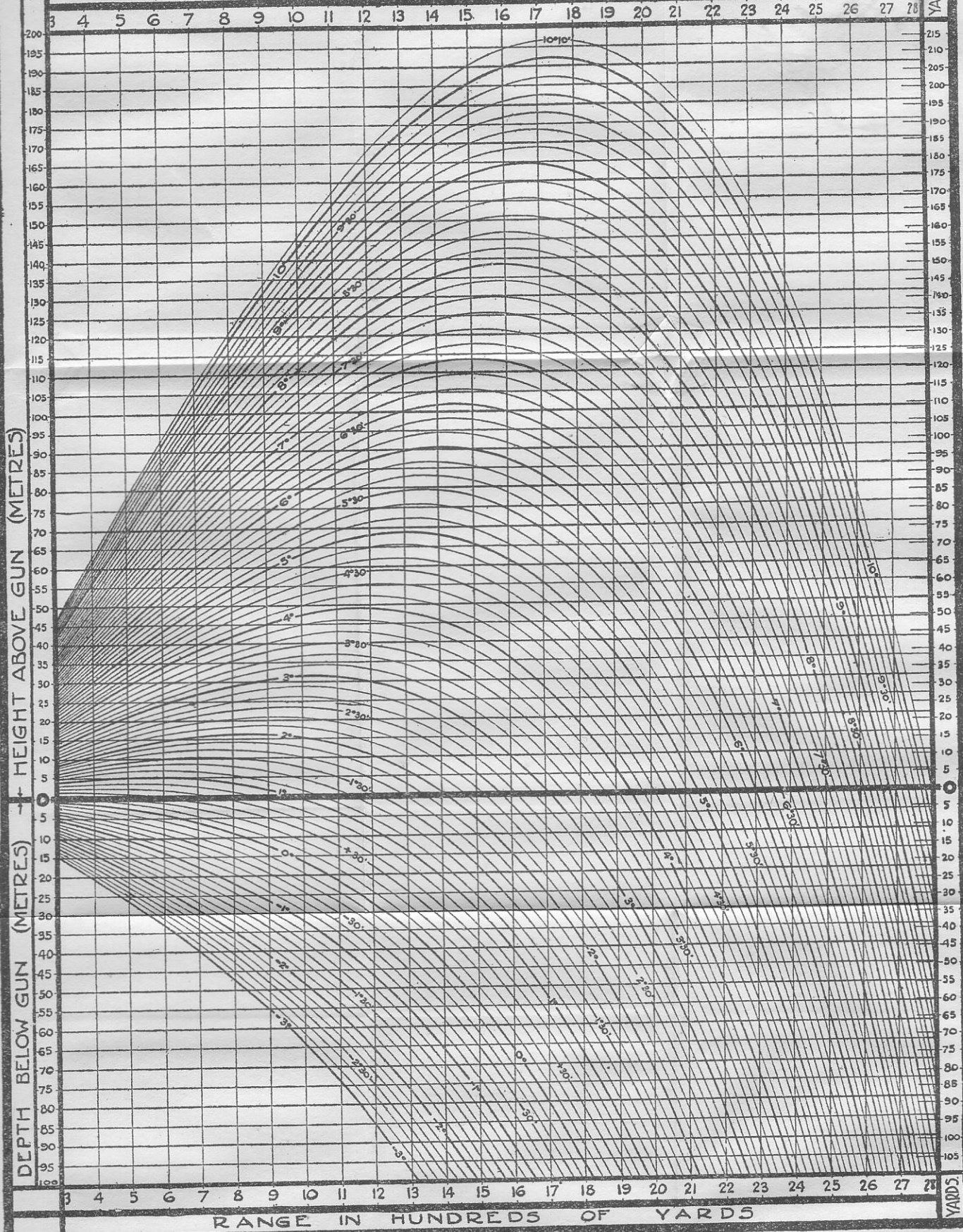
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(CURVES REPRESENT CENTRE SHOTS)

DEPTH OF LOWEST SHOT BELOW CENTRE OF CONE AT VARIOUS DISTANCES FROM GUN

IN YARDS	1'7	2'0	2'3	2'7	3'0	3'3	4'0	4'7	5'3	6'0	6'7	7'3	8'0	8'7	9'3	10	13'3	16'7	20	25	30	35	42	48
IN METRES	1'6	1'8	2'1	2'5	2'7	3'0	3'7	4'3	4'8	5'5	6'1	6'7	7'3	8'0	8'5	9'1	12'2	15'3	18'3	23	27	32	38	44

RANGE IN HUNDREDS OF YARDS



RANGE IN HUNDREDS OF YARDS

10	10	10	10	12	14	16	18	21	25	28	32	37	42	48	55	63	73	CLEARANCE IN METRES	
11	11	11	11	13	15	17	20	23	27	31	35	40	46	53	60	69	80	CLEARANCE IN YARDS	

MINIMUM CLEARANCES REQUIRED AT VARIOUS DISTANCES FROM GUN.

HOW TO USE THE GRAPH.—To FIND Q.A.: Take range and run up on vertical scale to height of target above or below gun. The curve cutting this point gives required Quadrant Angle.

TO FIND CLEARANCE.—Follow this curve along, and ascertain at what height it passes vertically above a point plotted to show distance and height (above or below gun) of own troops (or obstruction). This gives clearance in yards (right-hand scale), or metres (left-hand scale), from centre shot to ground.



## APPENDIX III

## V.I. GRAPH

i. The angle is shown by the diagonal line nearest to the point of intersection of the required base line (vertical) and the range line (horizontal).

ii. Both base and range must be taken in the same unit of measure, i.e., both in yards or both in metres.

iii. The smallest range (or H.E.) given on the graph is 1,000 yards. Therefore, if the range is less than 1,000 yards a convenient multiple of the range must be used and the same multiple applied to the base (or V.I.).

Examples :

(a) Given, range 800 yards and base 30 yards.

Find the angle.

A convenient multiple is 2.

Then range 1,600 yards and base 60 yards gives the angle  $2^{\circ} 9'$ , which is the angle required.

(b) Given, range 50 yards and angle  $1^{\circ} 10'$ .

Find the base.

A convenient multiple is 20.

Then, range 1,000 yards and angle  $1^{\circ} 10'$  gives a base 20 yards.

Therefore the required base is 1 yard.

Scale for the conversion of OBLIQUE bases to TRUE bases.

This is used as follows :—

i. Measure the angle of obliquity.

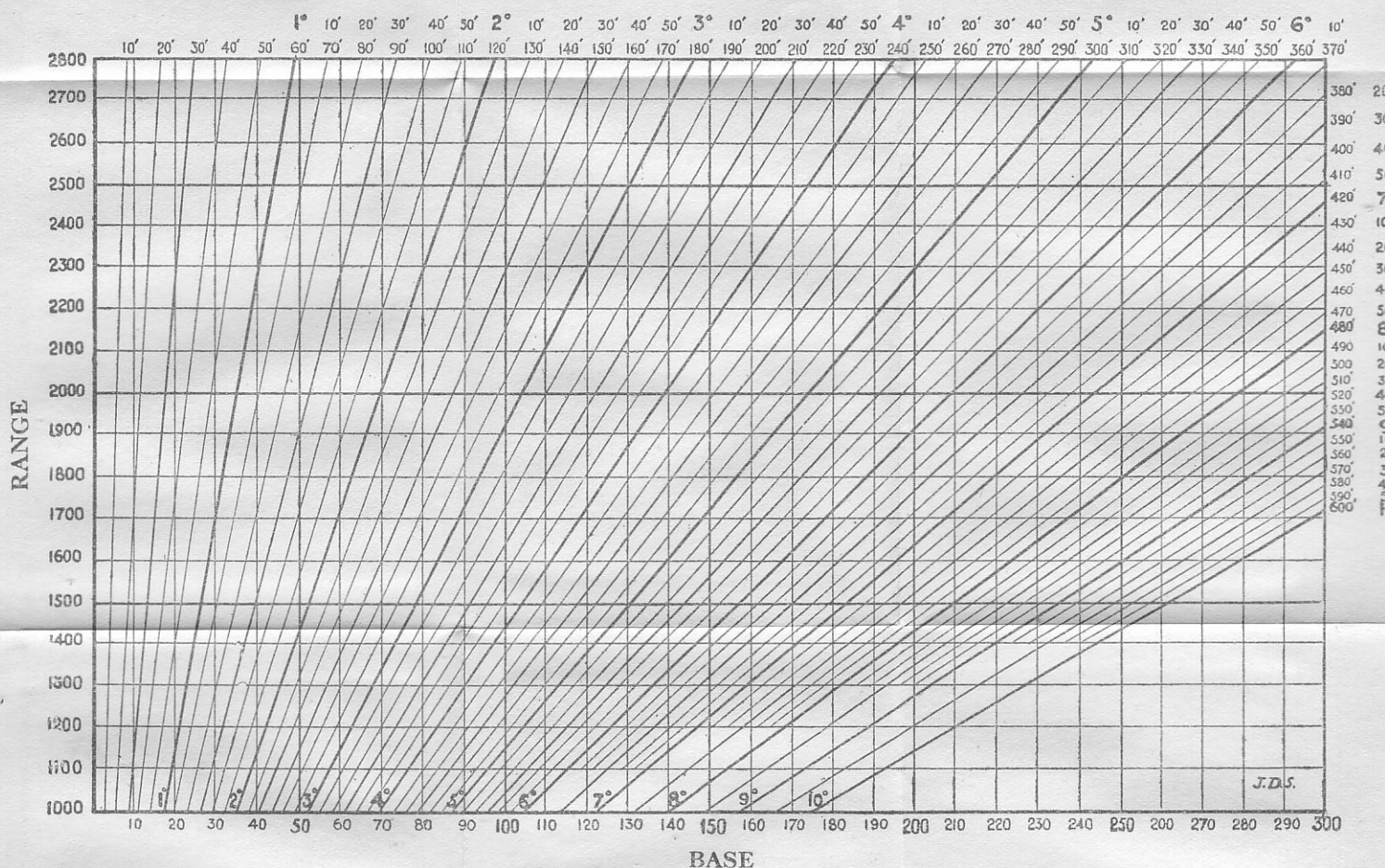
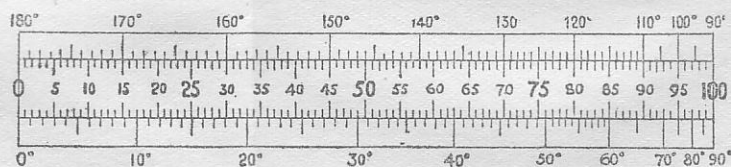
ii. Note the position of this angle on the TOP or BOTTOM lines of figures on the Scale.

iii. Note which figure on the centre line of figures comes opposite the angle measured.

iv. This figure will give the proportion of the oblique base which will equal the true base.

Example :—Base 80 yards long at an angle of  $125^{\circ}$ .

From scale, 75 % of oblique base equals true base, which is 60 yards.



Note.—The following formula will give approximately the information supplied by the above graph:—Angle in minutes =  $A = \frac{VI}{HE} \times 3.4$

where VI = vertical interval or base in yards or metres.

HE = Range or distance in yards or metres, and both are measured in the same unit



## APPENDIX IV

## INFLUENCE OF GROUND UPON BEATEN ZONES

For explanation of this table see Sec. 50

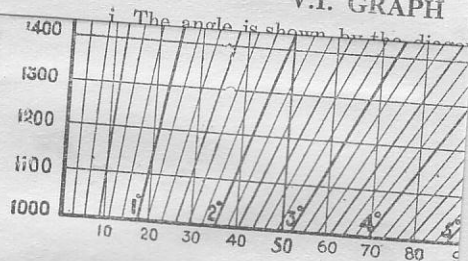
Table for calculating the reduction (or increase) of a beaten zone falling upon a forward (or reverse) slope

Range in Yards.	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800
<i>Gradient of Ground.</i>												
<i>Forward Slope—</i>												
1/8.5	.07	.12	.18	.28	.38	.46	.54	.61	.68	.74	.79	.82
1/12	.10	.16	.26	.36	.47	.54	.61	.68	.75	.80	.83	.86
1/20	.16	.21	.32	.46	.59	.67	.72	.78	.83	.87	.89	.91
1/50	.30	.40	.56	.67	.76	.82	.86	.91	.94	.95	.96	.96
1/100	.48	.61	.73	.80	.85	.89	.92	.94	.95	.96	.97	.98
<i>Flat</i>	1	1	1	1	1	1	1	1	1	1	1	1
<i>Reverse Slope—</i>												
1/100	...	...	1.60	1.30	1.20	1.13	1.09	1.07	1.05	1.04	1.03	1.02
1/50	...	...	...	...	1.50	1.33	1.22	1.16	1.13	1.09	1.07	1.06
1/20	...	...	...	...	...	...	1.74	1.45	1.32	1.22	1.17	1.12
1/12	...	...	...	...	...	...	2.13	1.67	1.42	1.28	1.22	1.22
1/8.5	...	...	...	...	...	...	...	2.22	1.81	1.45	1.34	1.34

*Example (Forward Slope).*—Range 2,000 yards; gradient of forward slope on which the shots are falling, is found to be 1 in 20; the beaten zone at 2,000 yards is 130 yards long; from the table, the factor in the vertical column under "2,000," opposite "forward slope 1/20," is 0.78. The beaten zone on the slope will be  $130 \times 0.78 =$  say, 100 yards.

age 355

## V.I. GRAPH

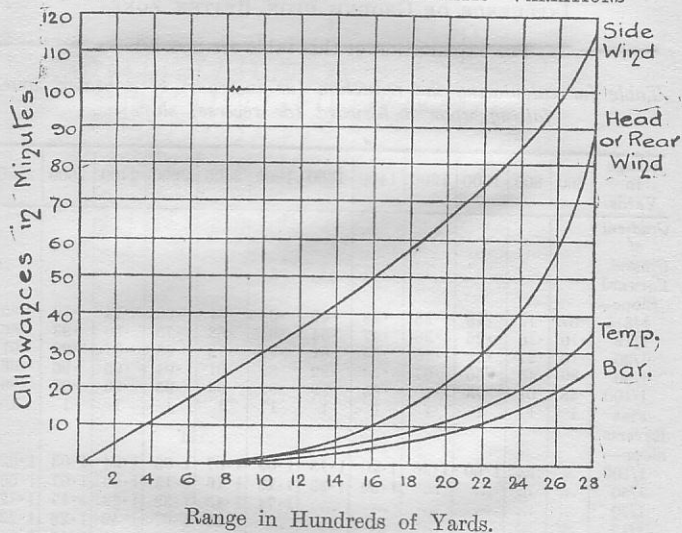


*Note.*—The following formula will give approx. 3,400,  
 where VI = vertical interval or  
 HE = Range or distance in ya

## APPENDIX V

(See Sec. 51, 5)

GRAPH OF ALLOWANCES FOR CLIMATIC VARIATIONS



Side wind curve  
Head or rear wind curve } are for 20 miles per hour wind.  
Temperature curve is for a variation of 20° from normal (60° F.)  
Barometer curve is for a variation of 1 inch from normal (30 inch), at mean sea level (M.S.L.).

## EXAMPLE

Range 2,000 yards. Bar. 28.5" Temp. 90° F. Wind oblique from Right Rear, 30 m.p.h.

## Elevation

From barometer curve :			
Allowance for 1" variation	...	...	= 8'
∴ " " 1½" "	...	...	= 12'
This must be deducted	...	...	= - 12'
From temperature curve :			
Allowance for 20° variation	...	...	= 12'
∴ " " 30° "	...	...	= 18'
This must be deducted	...	...	= - 18'
From rear wind curve :			
Allowance for 20 m.p.h.	...	...	= 22'
∴ " " 30 "	...	...	= 33'
This must be halved as wind is oblique	...	...	= 16'
This must be deducted	...	...	= - 16'
Total allowance for elevation	...	...	= - 46'

## Direction

From side wind curve :			
Allowance for 20 m.p.h.	...	...	= 66'
∴ " " 30 "	...	...	= 99'
This must be halved as wind is oblique	...	...	= 50'
Wind is from right ∴ Allowance is to right	...	...	= 50' right.

## APPENDIX VI

## TESTING AND ADJUSTING CLINOMETERS AND ANGLE OF SIGHT INSTRUMENTS

(A).—*Clinometer, Vickers .303-inch M.G., Mark I**Testing and adjusting*1. *To test.*

- i. Set scales to zero.
- ii. Place clinometer on gun, elevate or depress until bubble is in centre of run.
- iii. Reverse clinometer and note position of bubble.
  - (a) *If central*, the clinometer is probably in adjustment, but confirm at, say, 10 deg. dep. and 10 deg. elevation.
  - (b) *If displaced*, this indicates that an error is present.
- iv. In the case of (b) leave the clinometer on gun and rotate minute scale until the bubble is again central, then note the scale reading.
- v. Having noted the variation from zero, halve it and set the scale to this point, *e.g.*, suppose that reader points to 20 min. E., remove clinometer and set scale to 10 min. E.
- vi. Replace on gun and proceed as in (ii) and (iii). If the bubble does not come central, repeat process.

*Note.*—When rotating minute drum always turn to the left last, *i.e.*, anti-clockwise.

Should an error be found, it will be seen that when the clinometer is truly horizontal there will be a variation in the zero reading. This error can be noted or scales adjusted.

2. *To adjust.*

With a spanner unloose the “nuts securing micrometer collar,” set scale to zero and tighten up.

If the variation is large, it may be necessary to reset the degree reader. This is done by loosening the two securing screws and sliding reader to right or left, as may be necessary, and clamp up.

(B).—*Angle of sight instrument, Mark II**To test and adjust the instrument.*

## 3. Lay out a horizontal line. This is done as follows:—

- i. Select a position where there are two walls or upright posts, and about 200 yards apart, and as far as possible on the same horizontal plane. (See Fig. 45.)

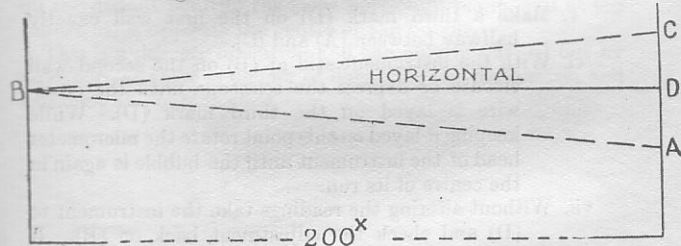


Fig. 45.

- ii. Take the instrument to one wall (A), if possible at the corner of a house. Set the angle of sight scale to zero, direct the telescope at the other wall

and bring the bubble to the centre of its run. Look through the telescope and direct someone to mark the point where the cross-wire cuts through the distant wall (B). Mark the wall where you are standing at (A) the same height as the *object glass* of the instrument.

- iii. Take the instrument to the distant wall (B) and place the object glass against the mark (B) made on it. Still keeping the angle of sight scale at zero, bring the bubble to the centre of its run. If the instrument is in adjustment the cross-wire should be in line with the mark (A) on the first wall and the line between the two marks is in a horizontal plane.
- iv. If such is not the case direct someone to mark on the first wall (A) another point (C) on which the cross-wire is layed, the bubble being central.
- v. Make a third mark (D) on the first wall exactly halfway between (A) and (C).
- vi. With the instrument still at (B) on the second wall elevate or depress the telescope until the cross-wire is layed on the third mark (D). While keeping it layed on this point rotate the micrometer head of the instrument until the bubble is again in the centre of its run.
- vii. Without altering the readings take the instrument to (D) and check the adjustment back on (B). If correct, a line between these marks is in the same horizontal plane.

When once a horizontal line has been obtained any number of instruments can be checked and adjusted on it.

4. Having now layed out a horizontal line, proceed to adjust the instruments. Set the degree and minute scales to zero. Place the object glass at one end of the horizontal line and lay the right end of the cross-wire in the instrument on the point at the other end of the line layed out.

The centre of the bubble should then be in line with the horizontal cross-wire in the instrument.

5. If it is not, turn the micrometer head until it is so. Loosen the two small outer screws on the top of the micrometer head and rotate the "minute skin" until it reads zero. Tighten up the screws.

6. If the degree scale is found to be more than a few minutes off zero, it will be necessary to start afresh and manipulate the screw supporting the cased bubble until, the scales being at zero, the horizontal cross-wire in the instrument is layed on the distant point in the same horizontal plane, and at the same time is opposite the centre of the bubble.

This is a delicate operation and can only be carried out by an expert, as there is danger of damaging the mechanism and smashing the bubble glass.





# APPENDIX IX.

FIGHTING MAP.

PLATOON OR SECTION.

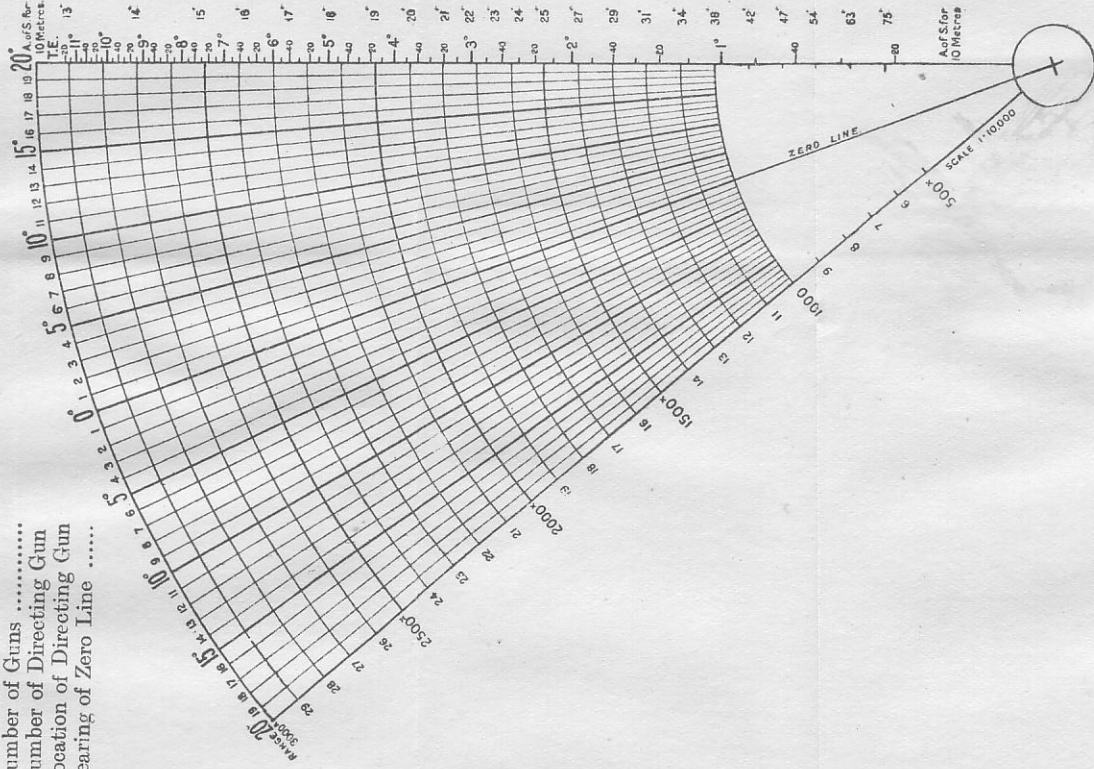
Ref. Map.....

Number of Guns .....

Number of Directing Gun

Location of Directing Gun

Bearing of Zero Line .....



Date.....

Platoon Commander



## APPENDIX X

## TESTING OF RANGE-FINDERS

1. All range-finders will be tested once in every six months under arrangements to be made by brigade commanders. A fully qualified officer will be selected to superintend. This officer will carefully inspect and adjust the range-finder before the test.

2. The test must be carried out very deliberately and only under the most suitable weather conditions, *i.e.*, clear light, no mirage present, &c.

3. The test will be carried out as follows :—

i. Four easy range marks will be selected, one each to be within the following limits :—

600—1,000 ; 1,000—1,500 ; 1,500—2,000 ; 2,000—3,000 yards.

ii. The actual distance of these points will be ascertained from a 25-in. to 1-mile map, if obtainable. If such a map is not obtainable these distances may be obtained from a 6-in. to 1-mile map, but in this case, unless great care is taken in the measurements, and the contraction or expansion of the map allowed for, considerable errors will arise. Where no large scale maps are available, the points must be accurately fixed by triangulation.

iii. The instruments under trial will first be adjusted for “zero” on the rods in their wood cases, care being taken before doing so to ensure that the

distances between the rods are correct and that the rods are not bent.

iv. Ten readings will then be taken of each range point with each range-finder under trial. A good instrument will register the distances within the following percentages :—

600—1,000, 1 per cent.

1,000—1,500, 1·5 per cent.

1,500—2,000, 2 per cent.

2,000—3,000, 3 per cent.

v. Each instrument should be tested by at least two expert range-takers. Each expert will take the ten readings referred to in iv. above, and the results will be recorded.

vi. Each observer must agree with the “zero” setting obtained on the rods before testing the instruments on the test points.

4. Any instrument found defective will be reported to the C.O.O. of the command.



## APPENDIX XII

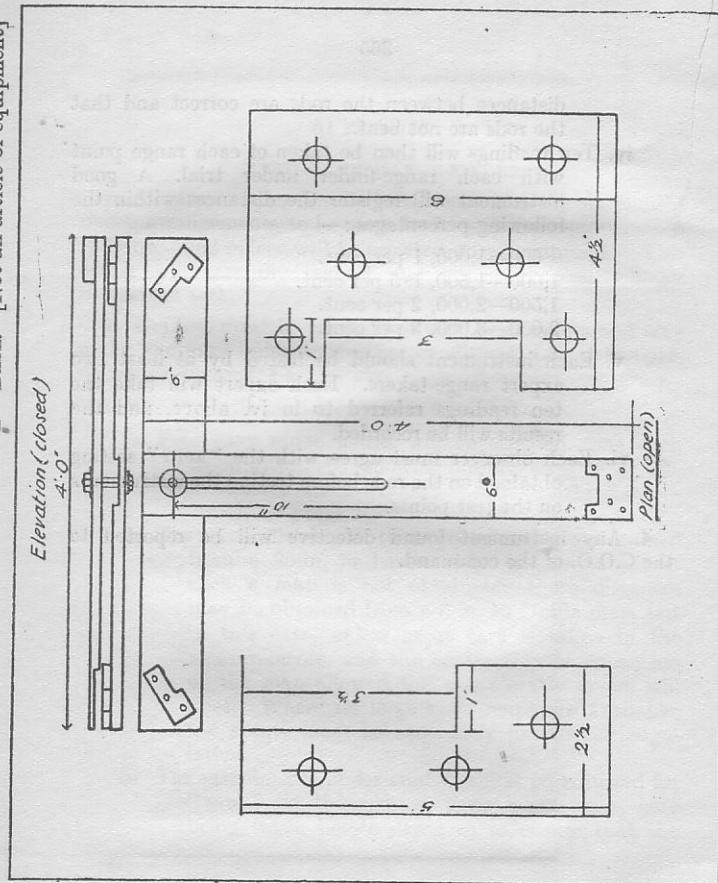
## TESTING MACHINE-GUN BARRELS

1. A machine-gun barrel is said to be inaccurate when a number of shots fired from it by a skilled firer using reliable ammunition, a good tripod, and in still atmosphere, strike a large target at several points widely distant from each other.

2. Before proceeding to test a machine-gun barrel by diagram, therefore, every care must be taken to eliminate as far as possible all avoidable sources of error, both in the mounting and in the ammunition.

3. In the conduct of tests the following rules must be carefully observed in order to ensure that reliable data are obtained as to the condition of the machine-gun barrel under trial:—

- i. The gun and barrel will be carefully overhauled by an armorer and any defects noted.
- ii. The mounting will be overhauled by an armorer and as far as possible all looseness in the joints taken up.
- iii. A reliable batch of ammunition will be used, of uniform make, carefully inspected and loaded into belts, and spaced into ten-round groups.
- iv. A reliable firer will be selected, who will fire through-out the series.
- v. A favourable day will be chosen.
- vi. The tripod will be mounted in the normal position.
- vii. The distance will be 500 yards.



- viii. A square target of not less than eight feet side and covered with white paper will be used.

The target will be carefully ruled off into squares of six inches side, and a suitable black aiming mark, *e.g.*, a square of black paper of one foot side will be provided.

- ix. Aim will be taken as directed in the rules for aiming, and the elevation used will be noted. Should there be any lateral effect due to wind, it may be necessary to move the aiming mark to the right or left as may be required.
- x. Before applying fire to the target at least 30 rounds should be fired through the gun directed at a point on the stop butt alongside the target in order to settle down the mounting.
- xi. Fire can now be directed at the aiming mark, and a burst of ten rounds fired.

The ten rounds must be fired in one burst. Should any stoppage occur, the target will be patched out and the practice repeated.

- xii. When the firing of the group has been completed, the target will be examined to ascertain if there are ten clean shot-holes visible. Should there be more or less than ten hits, the target will be patched out and the practice repeated.
- xiii. If there are ten shot-holes visible, the position of these hits will be recorded carefully by measuring, from the bottom left-hand corner of the target, the horizontal and vertical distance of each shot-hole in feet and inches, and transferring same direct to A.F. B 202, or preferably entering in a note-book

in two columns, giving horizontal and vertical measurements of each shot.

The position of the "point aimed at" must also be recorded in the same manner.

- xiv. Three diagrams will be taken with each barrel to be tested.

4. The "figure of merit" of the barrel will then be computed in the following manner:—

- i. The position of each shot will be plotted on A.F. B 202, measured from the left-hand bottom corner of the diagram according to the measurements taken down.

Each shot will be numbered consecutively one to ten, and at the same time the horizontal and vertical measurements will be entered in feet and decimals of a foot to two places, in the column provided for the purpose.

- ii. Similarly, the position of the "mark aimed at" will be plotted on the diagram and marked "X," and its measurements entered in the space provided.

- iii. Each column will then be totalled and the means found. The point of intersection of the line representing the mean, horizontal and mean vertical positions of the group will give the position of the "point of mean impact." This point will be marked on the diagram thus ○.

- iv. A rectangle will now be drawn which just embraces the group of ten shots, and the horizontal and vertical measurements entered in the summary.

7. The distance of each shot from the "point of mean impact" will now be measured and entered consecutively in the column headed "deviation from point of mean impact." The mean of the deviation gives the "figure of merit" of the barrel. The "figure of merit" will show the accuracy of the barrel. When the average of the "figures of merit" of three diagrams exceeds 1.5 feet, the barrel will be reported as inaccurate.

5. The various headings of A.F. B 202 will be filled up, giving full particulars regarding the mark, source of manufacture of the gun and barrel, and the mark, lot, date, and place of manufacture of the ammunition.

The direction and strength of the wind should be noted, but its effect on a group of ten shots, individually, is so small as to be negligible.

By the above method it is possible to compare the relative steadiness of different mountings, provided that gun, barrel and ammunition are known to be reliable.

Also, by ensuring that gun, barrel and mounting are reliable, it is possible to compare the various "lots" of ammunition.

## APPENDIX XIII

### ORGANIZATION OF MACHINE-GUN BARRAGE FIRE

1. The effectiveness of a machine-gun barrage will depend principally upon the following factors:—

- i. *The dangerous zone.*—This will vary greatly with the range employed, because, the longer the range the shorter will be the dangerous zone. A forward slope will also reduce the extent of the dangerous zone.
- ii. *The number of rounds fired per minute.*—Because the less the number fired the less the chance of damaging the enemy while he is passing through the dangerous zone, and *vice versa*.
- iii. *The speed of enemy advance.*—Because the quicker he passes through the beaten area the fewer the bullets he will meet in that time, and *vice versa*.
- iv. *The frontage allotted to each gun.*—This will affect the density of the barrage. The greatest frontage which should normally be allotted to each gun is 50 yards. If there are not sufficient guns to cover the whole line to be barraged on a frontage of 50 yards (or less) for each gun, it becomes a matter for consideration whether it would not be better to apply an effective barrage to the more important parts of the line, leaving gaps to be dealt with by co-operation of other arms, rather than to put down what might prove to be an ineffective barrage over the whole line.

2. *Rates of fire.*—To prevent waste of S.A.A., to ensure time for re-laying and oiling (thereby prolonging the life of the gun), and to enable estimates of S.A.A. to be made in advance, rates of fire must be laid down for rigid observance by each gun. (*See Sec. 49, 8.*)

Before rates of fire are ordered, the following factors must be considered :—

- i. Tactical requirements of the barrage.
- ii. Frontage for each machine gun.
- iii. Time during which the barrage is to be fired.
- iv. Rate at which belts can be filled.\*
- v. Wear and tear of machine guns.

3. *Frontal, oblique, and flanking barrages.*—The fact that a barrage may be oblique or flanking does not affect the frontage which can be engaged by each machine gun, other things being equal.

The frontal barrage is the most common form, as it is usually easier to arrange and control : it has the disadvantage that the safety of our own troops may require that the barrage should not be put down nearer than 300 or 400 yards in front of them. This disadvantage may be overcome in certain cases by clearing our own troops out of the line of fire a short way on either side.

The flanking barrage may be put down much closer to our own troops than the frontal barrage, but owing to difficulty in siting machine-gun positions, it cannot often be employed.

The oblique barrage has the advantages and disadvantages of the frontal and flanking types according to the degree of obliquity.

\* This consideration will not apply when factory filled (stripless) belts become available.

Frontal and oblique barrages require traversing; the flanking barrage does not. Two parallel flanking barrages about 60 yards apart should be employed rather than a single flanking barrage from the same total number of guns.

Box barrages are frequently required for such purposes as raids, &c. These barrages can be obtained by a combination of frontal with oblique or flanking fire.

4. An example of a small barrage scheme worked out from the map and actually carried out during the Great War is given below. The references are to the squared maps then in use. (*See Sec. 26, Manual of Map Reading, 1921.*)

#### (A.) *General remarks*

5. Our own and the enemy trenches are as shown in Plate XXVIII (page 374). A night raid is contemplated on the craters between the lines south of St. Eloi with the following objects :—

- i. To obtain identifications, capture prisoners and inflict casualties.
- ii. To destroy the enemy works and emplacements.

6. The brigade machine-gun officer receives instructions to put down a machine-gun barrage to effect the following purposes :—

- i. To prevent reinforcements reaching the salient.
- ii. To keep down fire.
- iii. To block the trenches on either side of the salient.
- iv. To be prepared to engage with intense fire certain headquarters and defended posts after the termination of the raid.



(B.) *Action by brigade machine-gun officer*

7. Considering the problem of how to block the trenches on either flank, it is doubtful, owing to the proximity of our line to that of the enemy, whether a frontal barrage can be employed for this purpose, which will allow a sufficient clearance over our own trenches.

An inspection of the map confirms this. The distance between the lines is only about 250 yards, and the shots would not pass at a sufficient height over our own trenches. He therefore decides to employ enfilade barrages to form these blocks, which are shown in Plate XXVIII. That on the right flank can be put down by a platoon ("C") whose position is off the map, but within the brigade area. He finds that on the left flank it necessitates a gun position which falls within a neighbouring brigade's area. He therefore arranges for the brigade on that flank to carry out this task, and sends particulars of the area to be engaged, times, duration of fire, rates of fire, &c. (The positions of these blocks and the lines of fire from the platoons are shown in Plate XXVIII.)

8. He then considers the location of the barrage required to isolate the salient; this should be as close as possible to the line to be raided as is consistent with the safety of our own raiding troops. Their most advanced position will be the line of the craters.

The gun positions must therefore not be more than 2,000 yards from the craters. (*See Sec. 69, 5, ii.*)

Using his knowledge of the ground and existing conditions, he begins by choosing a suitable gun position at "A."

9. He now considers how close the barrage from this gun position can be placed in front of our own troops. By inspection

of the map (Plate XXVIII) he sees that the most advanced point to which our own troops will reach will probably be the crater at 2.d.33.80; the distance of this point from the gun position is 1,700 yards, and it lies 20 metres above the gun position. The safety clearance required at 1,700 yards is 48 metres; by reference to the graph he finds that the curve representing 5° 30' Q.A. passes at 49 metres above a point which is 20 metres above the gun and 1,700 yards from it. On the graph this trajectory cuts the zero line at a point approximately 500 yards beyond our own troops. At this point on the map, however, the ground is 15 metres above the gun position; looking again at the graph, he finds that a trajectory just below the 5° 30' trajectory would strike ground which is 15 metres above the gun position, at a range of 2,130 yards. This locates a point 2.d.74.06, and he assumes that a line drawn at right angles to the line of fire through this point will give sufficient clearance on either flank of this platoon's task, as the positions of our own troops are not so advanced on the flanks. He therefore draws a line between the points 3.c.09.23 and 8.b.29.86.

10. The total frontage to be covered is about 800 yards: the brigade machine-gun officer therefore decides to allot this frontage equally between two platoons (as shown in Plate XXVIII), each of eight guns, since the conditions are similar for each. This gives about 400 yards to each platoon. The positions for these platoons (which have been located up to to this stage, partly by calculation, and partly from his general knowledge of the ground, existing positions, communications, &c.) should be reconnoitred by himself, together with the platoon commanders who are undertaking the barrage, and the positions definitely fixed.

It is assumed in this case that the positions selected are found suitable.

(NOTE that the fire of "A" and "B" platoons is arranged to cross, since it will be apparent from inspection of Plate XXVIII that this arrangement permits of the barrage being closer to the assault line than would be possible otherwise, owing to the safety clearances over our own front trench lines.)

11. In considering the rate of fire, he decides to put down rapid fire for the period from zero to zero plus 5 minutes, to cover the first phase of the assault, and to keep down the enemy fire while our own troops are advancing. From zero plus 5 to zero plus 15 minutes, while our troops are in the craters, he fixes the rate at 120 rounds per minute, quickening to 300 per minute if the situation demands it; and from zero plus 15 to zero plus 20 minutes, at 300 rounds per minute, to cover the withdrawal.

12. The brigade machine-gun officer now proceeds to fill in his charts for each platoon, giving the following details:—

Location of the platoon.  
Location of tasks.  
Times, and rates of fire.

He gives these charts to the platoon commanders, who make all calculations, complete their fire direction charts, and send them to the brigade machine-gun officer for checking.

(C.) *Action of platoon commander*

13. On receipt of the fire direction chart from the brigade machine-gun officer, the platoon commander proceeds to work out the fire direction chart.

For example, the calculations for "A" platoon would be as follows:—He decides that his zero line shall coincide with the left of the barrage line, No. 8 gun directing. This gives a bearing for the zero line of  $146^{\circ} 30'$ . There is, therefore, no angle of switch for this barrage.

Plotting the gun position on the map, he now finds the angle of distribution.

He has already found the bearing from the directing gun to the left of the target ( $=146^{\circ} 30'$ ): that between the right gun and the right of the target is  $157^{\circ}$ . By dividing the difference between these (*i.e.*,  $10^{\circ} 30'$ ) by the number of gun intervals (7), an angle of distribution of  $1^{\circ} 30'$  is found.

For the directing gun: Range= $2,150$  yards; V.I. =  $+20$  metres, giving a Q.A. of  $5^{\circ} 40'$ .

The traverse is  $1^{\circ} 30'$  right and  $1^{\circ} 30'$  left.

By inspection, the clearance will be least on the line of fire of No. 5 gun, and is ascertained as follows from the graph:—

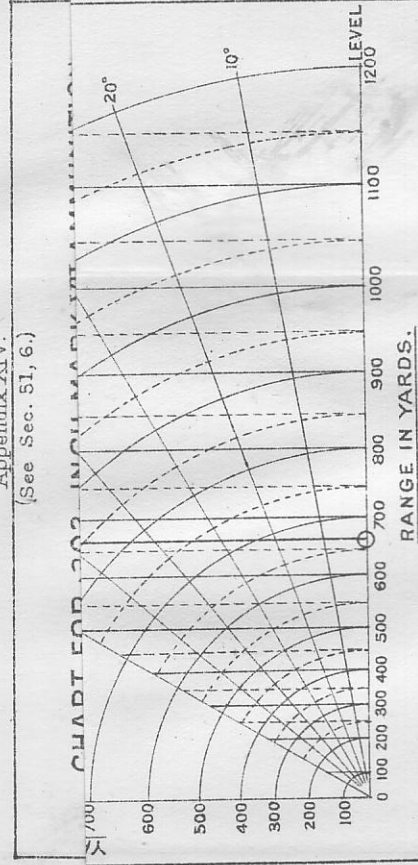
Q.A.  $5^{\circ} 30'$ ; distance of own troops from gun= $1,700$  yards; height of own troops above the gun= $20$  metres; clearance of centre shot= $49$  metres; minimum clearance required= $48$  metres.

14. For the headquarters allotted as task 2, it will be sufficient to swing the guns round on parallel lines, and the remainder of the detail presents no difficulties.

15. The fire direction chart having been completed and checked, the section commanders make out a chart for each gun-detachment commander.

To face page 37.

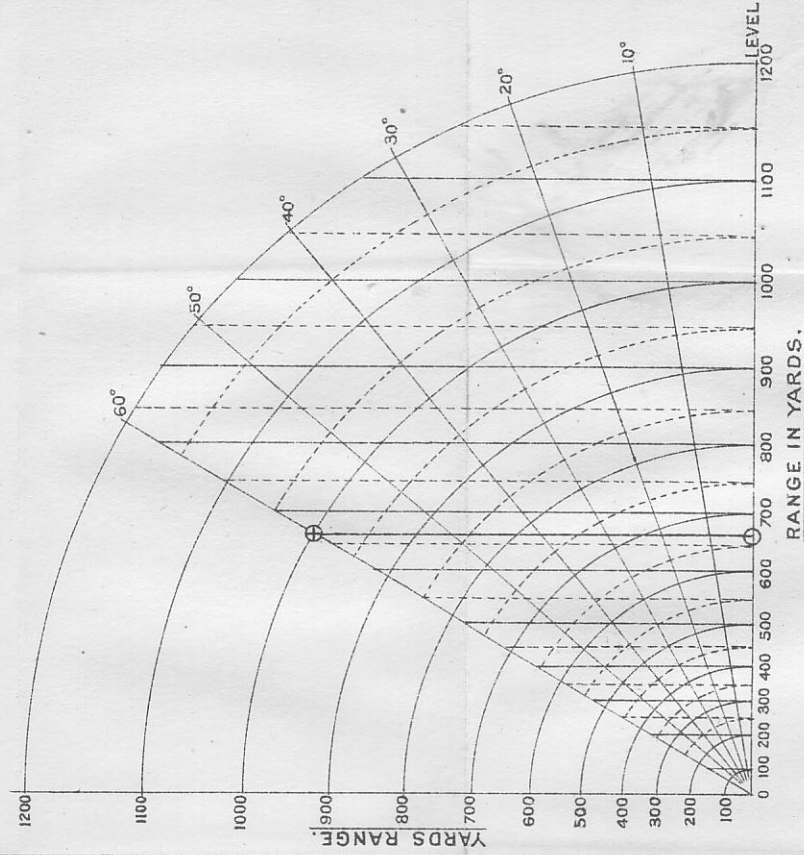
Appendix XIV.  
(See Sec. 51, 6.)



## Appendix XIV.

(See Sec. 51, 6.)

# CHART FOR 303-INCH, MARK VII AMMUNITION FOR FIRING UP OR DOWN HILL.

EXAMPLE.*Range of Target is 1000 Yards.**Angle of Sight is 60°.**Spot intersection of 60° line and 1000 Yards circle of Mark ⊕ come down vertically on to line marked "LEVEL" and read range there at Mark ○ as 660.*Set sight to 660 Yards.NOTE: *Corrections for Barometer and Thermometer should be applied before using the chart.*



## APPENDIX XV

## INSTRUCTIONS FOR THE CARE AND USE OF LAMPS, AIMING, M.G.

1. Before the box is opened, the folding handle of the drum is to be opened out ready for use. This is important, as if the handle is left folded, the cable is liable to be pulled away from the connecting screws of the terminal plates of the lamps.

2. When the lamp is not in use, care should be taken to ensure that the switch is left at "Off" and quite clear of "1" and "2."

3. No projecting strands of wire should be allowed to touch any terminal other than that to which they are attached. Particular care should be taken to prevent any exposed wire from touching the terminals of the spare cell.

4. The folding handle of the drum should be restored into its slot when the box is closed for travelling.

5. When the cable is being unwound, both wires should be unwound together. Speed should not be attempted. The lamps should not be held in the hand but by the wire about a foot from the lamp. Neglect of this precaution may result in the lamp being jerked and the connection carried away should the cable jam on the roller. During unwinding, the man at the box should take care that no loose coil of cable is allowed to loop round the ends of the roller.

6. When the cable is being wound in, the following procedure is the simplest. The man should hold the body of the box between his knees, turn the handle with his right hand and

with his left hand lead the two cables, held as a double cable, regularly across the drum.

Regularity in winding in is essential to ensure that the cable can be instantly unwound when required.

7. A hole is left in one side of the box to allow of the box being closed when the cable is out and the lamp ready for use.

8. The coil of the adjustable resistance should be kept free from knocks and kept in its seating.

9. The word "Top" on the lamps indicates the position when on the target post, *not* when in the box.

10. When the cells are being placed in position it may be necessary to cut the cardboard edge in order to give the ebonite securing strip a good seating on top of the cells.

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NOTE.—No reference to drill movements or detail is made in this index. Headings of sections dealing with drill will be found in the Contents.

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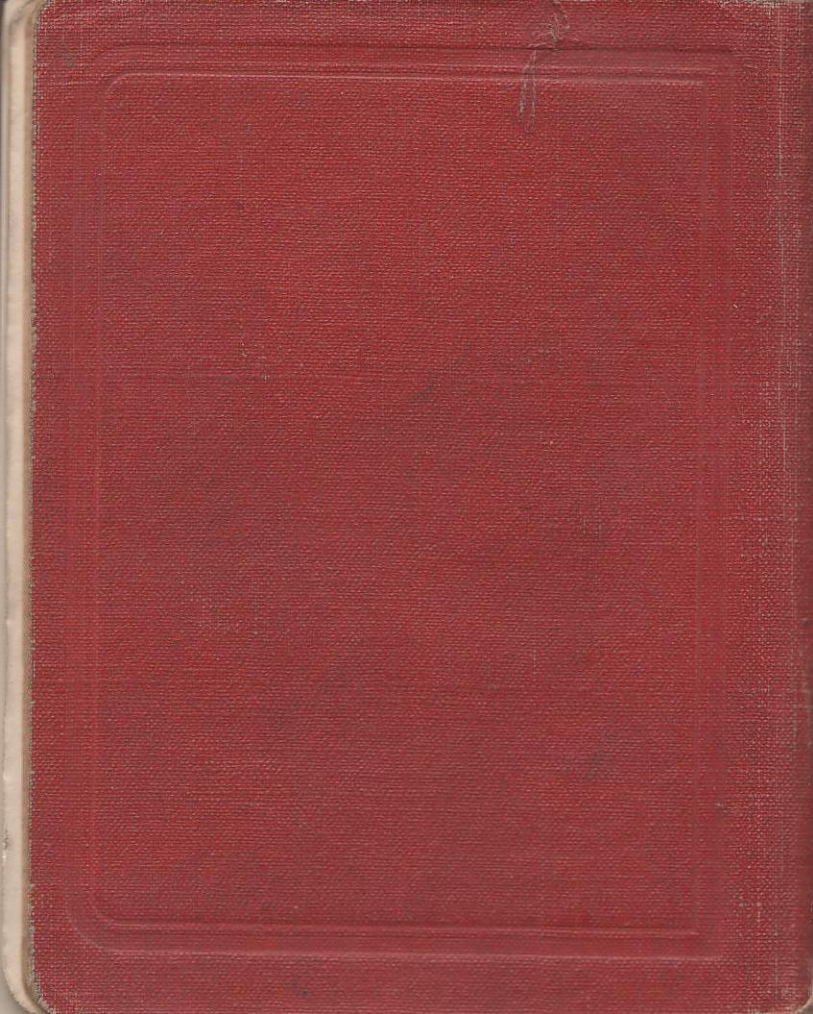
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